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JOURNAL OF THE AMERICAN
MUSEUM OF NATURAL HISTORY

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THE AMERICAN MUSEUM OF NATURAL HISTORY

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SEPT.-OCT.
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HAWTHORNE DANIEL
Editor

A. KATHERINE BERGER
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A MODERN CITADEL OF SCIENCE

Like the stronghold of knowledge that it is, the American Museum of Natural History looms up in this picture from an appropriate natural setting. This view, showing the southeast tower, was taken from Central Park

VOLUME XXX

NATURAL HISTORY

NUMBER FIVE

SEPTEMBER–OCTOBER, 1930

THE INSPIRATION OF NATURE

ON a scale hitherto unknown the American Museum of Natural History is advancing the knowledge and inspiration of Nature. Its activities encompass the globe and all prehistoric time, through vast ages to the feeblest beginnings of life. While chiefly recording the present life of the world, the study of the living races of man leads us back through the long human ancestral period and finally step by step through the increasingly long chapters which fill up the whole record of a billion years.

The field of Nature is limitless. Discoveries lead to discoveries in geometric progression. The more we learn, the more we learn to look for. The world today is the sum total of what we know about it; tomorrow's discoveries will show a different and richer world, which can best be defined and interpreted by such an institution as this Museum,—and then only as the Museum continues to search, to collect, and to evaluate.

Looking backward some six decades to the Museum's first foundation, which has been built upon so mightily, there is a temptation to congratulate ourselves upon gathering one of the vastest and most valuable natural history collections—upon bringing "the world under one roof." Yet we cannot be satisfied, for from this very achievement rises a new and ever-widening obligation to disseminate and diffuse this slowly gathered knowledge as broadly as possible, for from a knowledge of Nature come all health and all wealth.

This future usefulness, for which a spacious vista opens, depends upon the same factor that has made the Museum so fruitful in the past—an appreciation of its work and aims, which is ever the stimulus of the generous financial support hitherto accorded by the people of this community and country. Now that the American Museum faces the need for completion of its Sixtieth Anniversary Fund of $10,000,000 in order that our broad and significant searchings after world-wide truth may not falter, a summary of the Museum's activities seems timely in these pages of NATURAL HISTORY, which for thirty years have conveyed more of the Museum's achievements and results than of the essential means used in its attainment.

Complete description of the Museum and its work would require several volumes. Hence, though forming the first account, appearing in a single issue, of the principal Museum activities—Exploration, Research, Preparation and Exhibition, Education, and Publication—the following articles by Museum people are, perforce, summaries only. They are submitted, nevertheless, with the earnest hope that they may convey to the readers of NATURAL HISTORY new and stimulating glimpses into the methods, enterprises, and problems of the American Museum.

Henry Fairfield Osborn

THE AMERICAN MUSEUM OF NATURAL HISTORY

A Brief Statement of Its Inception and Growth

As life on this earth had small beginnings, so had the American Museum of Natural History. Influenced by his teacher, Louis Agassiz, Albert S. Bickmore, while yet a student, conceived the idea that a great natural history museum should be established in New York City. This view he broached first to William Earle Dodge, 2d, and later to the elder Theodore Roosevelt, both of whom were destined to become founders. Presenting a well-matured plan, the young man eventually obtained through them the interest and activity of a remarkable group, in which were New York's great business and civic leaders of the day.

After making a tentative agreement with the Commissioners of Central Park as to housing and an approach to citizens for funds with which to purchase important collections, this group organized the first Board of Trustees of the American Museum. In its statement of the aims of the Founders, the first annual report was prophetic. In part it said:

"That, recognizing the necessity of such a Museum as a means of education and recreation, and desiring its establishment upon a scale commensurate with the wealth and importance of our great city . . . we have, if properly supported and aided with funds by our fellow citizens, a guarantee of a prosperous future in the formation of a Museum of Natural History that will be second to none, and which, while affording amusement and instruction to the public, will be the means of teaching our youth to appreciate the wonderful works of the Creator."

The same vision was in the minds of the park commissioners, who, on December 30, 1868, accepted the responsibility of "the establishment of a Museum in the Park that shall become an aid in the great educational system of the city, concentrate and develop scientific efforts in all branches of natural history, and at the same time be an instructive and acceptable resort for the people of the city, and for the throng of strangers that visit it."

The outcome was the establishment of a principle of operation and support, since widely adopted elsewhere, which was embodied in a wise and workable agreement drawn with the City by Joseph H. Choate, another of the Museum's distinguished founders. On the basis of its provisions the new museum thrived from the start, and has continued to grow amazingly toward its eventual physical goal—the complete occupation of the seventeen and one-half acres of Manhattan Square, part of the Central Park lands—and toward its scientific and educational goal of a country-wide and world-wide influence "second to none." The terms of this contract, in brief, established for all time two responsibilities: Erection and maintenance of the building by the municipality, and donation of all the collections by the trustees and other citizens.

The Museum, with its arrangements for administration already well under way, received its formal charter of incorporation April 6, 1869. By November $44,500 had been subscribed by citizens, and the Museum was soon enabled to purchase four important collections, comprising 9300 mounted birds, 200 fish and reptiles, 820 mounted animals, 4000 mounted skeletons of mammals, birds,

reptiles and fishes, and 250 specimens of Siberian fauna.

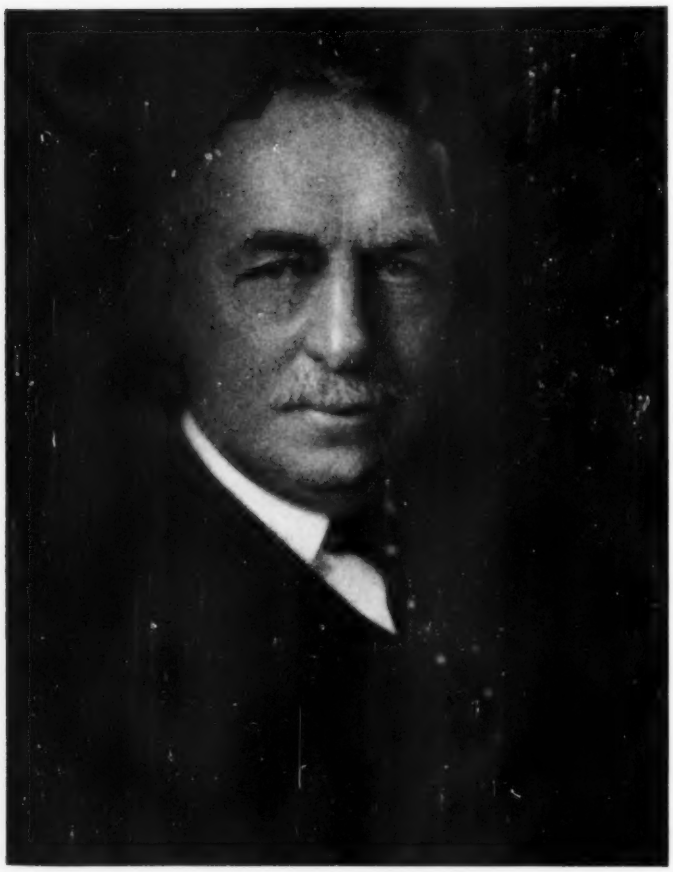
Though but the tiniest fraction of the collections eventually accumulated, these first accessions made a splendid nucleus. The problem of housing them for public display led first to the Cooper Union and then to the old Arsenal Building in Central Park, where the commissioners, validating their early interest in the project, turned over two floors and furnished new cases.

With the adapted Arsenal Building soon outgrown and the youthful Museum daily attracting more friends, there were made the first moves leading to erection of the great granite pile at Seventy-seventh Street and Central Park West. A petition enclosing 40,000 names of "the best and most valuable" citizens went to the Legislature on behalf of both the American Museum and the Metropolitan Museum of Art, then occupying private dwellings but soon to have its own home in the Park. Immediately the Legislature responded by authorizing the Department of Parks to erect and maintain a building suitable for display of natural history material. In the conviction that growth and greatness would come, it was decided to start a structure which eventually would form a hollow square 700 feet long on each side. This arrangement has since been adhered to, though certain interior wings not at first contemplated have been added. The first section was begun in 1874 with the laying of the corner stone by President Ulysses S. Grant. With completion in a few more months of the beautiful Roosevelt Memorial by the State of New York and another unit by the City, both facing Central Park, the original plan will have been half carried through.

© *by the Fairchild Aërial Survey*

AN AËRIAL VIEW OF THE AMERICAN MUSEUM OF NATURAL HISTORY IN 1930

The excavations shown in the picture are those for the State Roosevelt Memorial Hall, the African Hall, and the Power and Service Building. These buildings are now well under way



HENRY FAIRFIELD OSBORN
The fourth president of the American Museum, who has served in this capacity since 1908

The subsequent history of the American Museum has been one of almost continuous progress in its chief fields of exploration, research, preparation, exhibition, education and publication—an expansion of activity of which its lengthening edifice has been only an outward sign. In this progress thousands of men and women have had a share; yet to a few it was given to be reckoned among the great builders.

From Professor Bickmore, with his ability to organize and to obtain financial support, the Museum which was the dream of his youth received not only its real beginning but also a conception of what a museum should be. As the Museum's first superintendent and first curator of education Professor Bickmore was a powerful influence during all its formative years.

Though a business man untrained in science, Morris K. Jesup, inaugurated as third president in 1881, when the Museum's full acceptance of its opportunities was in jeopardy, lifted the institution to a position of eminence which attracted the attention of the whole scientific world. The great achievements of his administration, the climax of a service to the Museum which had been continuous from its founding, were attributable to a rare ability to envision the possibilities of scientific effort. These he developed by bringing to the Museum's staff notable scientists and to its treasury the funds with which to work.

To another founder, who for fifty-six years remained an active trustee, the Museum and all who have profited through what it offers owe a special debt of appreciation. The late J. Pierpont Morgan's business acumen, eagerness to recruit supporters for the Museum and large gifts to its projects were powerfully conducive to its achievement.

Coming to the Museum in 1891 to found a department of palæontology which was to attain preëminence, Prof. Henry Fairfield Osborn first became President Jesup's assistant, then in 1908 succeeded him,—to add new chapters to the book of achievement. World-known as exponent of science for

layman as well as scientist, the present president of the Museum brought in a fruitful era especially marked by elucidation to the public of what are generally held to be cryptic technicalities of science. "Dinosaur" has become a household word; to great hosts without the tools or language of science have been made plain the mysteries of the ages and obscurities of the present. With President Osborn at the helm the Museum has not only become a leader in this interpretive field, through the use of many media, but it has made a notable general progress and gained new levels of prestige.

Under such chieftanship the American Museum has often led and always gone forward, in step with scientific advance. And this has been steady, for searching and learning, science and education, never come to an end; Nature itself, and knowledge of Nature, never stand still; neither can a great Museum, which for the benefit of mankind holds up a many-faceted mirror.

The irreplaceable institution, glimpsed in the articles to follow, that has resulted from more than sixty years of devotion to a vision, is the work of many hands. What more the Museum may become in a world that will never cease to yield new mysteries for human examination and profit depends also upon the work of many hands.

A SECTION OF THE HALL OF THE AGE OF MAN

In this remarkable exhibition hall, the collections and murals tell the story of prehistoric man as he was in the great days of the glaciers and mammoths. This hall attracts its full quota of the 1,000,000 annual visitors to the Museum

Photograph by J. B. Shackelford

Roy Chapman Andrews, leader of the Central Asiatic Expeditions, in the sand dunes at Tsagan Nor

INCREASING KNOWLEDGE THROUGH EXPLORATION

How Exploration Has Changed from the Hit or Miss Method of an Earlier Day—The Value of the Work of the Museum in the Field

By ROBERT CUSHMAN MURPHY
Curator of Oceanic Birds, American Museum

The following article touches upon many phases of exploration, primarily as conducted over a long period of time by the American Museum. NATURAL HISTORY *is fortunate in being able to round out the subject by presenting, in two other articles in this issue, descriptions of specific expeditions—the most recent important Antarctic survey, conducted by an explorer not connected with the Museum, and a Siberian expedition conducted under the auspices of the Museum itself. These expeditions, of diverse type, are the Byrd Antarctic Expedition, as seen in some of its scientific aspects by its leader, Rear Admiral Richard E. Byrd, first man to conquer both poles by air; and the Morden-Graves Expedition, which brought back to the Museum specimens of rare fauna, described by William J. Morden, field associate of the department of mammals.*—THE EDITORS.

MANY visitors to the American Museum pause in a corner on the ground floor, near the entrance to the elevators, to inspect an outline map of the world dotted with black thumb-tacks. The markers tell the whereabouts of American Museum expeditions, concerning each of which there are a few marginal words. The position and number of the tacks is frequently changed as field parties start forth, shift their base, or return to New York. At the moment of writing there are seven such black spots on three continents and in Oceania, far flung around the globe from the Gobi Desert in the east to the Solomon Islands in the west—a point at which west becomes east again. At times, however, scores of tacks, scattered over every great land mass, certain remote islands, and one or both of the polar regions, have revealed unusual contemporary activity of field workers representing the American Museum of Natural History. The map is one indicator of how our institution

keeps its elongate fingers upon the pulse of nature.

Natural history museums were not always sponsors of exploration. Originally their function was passive, for they served mainly as repositories for objects from many different sources. The emphasis, unlike that of today, was placed upon the strange and the abnormal rather than upon orderly processes of nature such as are now recognized as having the greatest meaning and application. Information concerning specimens was regarded as of less importance than their mere possession, and most collections were reminiscent of Shakespeare's apothecary shop in which

> a tortoise hung
> An alligator stuff'd and other skins
> Of ill-shap'd fishes.

Even after natural history museums had begun to evolve beyond the primitive stage, they retained their original character to the extent that their property continued to be built up chiefly by gifts from acquisitive travelers, through the accumulation of private collections bequeathed by patrons and specialists, or through the purchase of natural history objects from professional collectors. The early treasures of our own institution were of this sort. In the second annual report of the Museum, devoted to the events of the year 1871, mention is made of large and valuable zoological collections purchased in Europe and at last safely deposited in the Arsenal in Central Park, the original home of the Museum. These comprised the entire museum of Prince Maximilian, of Neuwied, Germany. They were later to prove especially valuable to investigators because they included a large number of type specimens in several groups of ani-

Photograph by Walter Granger

EXCAVATING THE HIND LEG OF A DINOSAUR

The Central Asiatic Expeditions are responsible for the greatest discoveries of recent years in the field of fossil vertebrates, including the far-famed dinosaur eggs

Photograph by R. C. Murphy

THE AMERICAN MUSEUM AT AN OUTPOST OF THE ANTARCTIC

The expedition's brig "Daisy" at Cumberland Bay, South Georgia. The mossy slope beyond the vessel has since become the last resting place of Sir Ernest Shackleton

Photograph by G. Kingsley Noble

THE RARE SPIKE-TAILED IGUANA
(*Cyclura ricordii*)
A field study from one of the Angelo Heilprin Expeditions to Santo Domingo

mals. During the same period the Museum also acquired by purchase further important nuclei of its early representation of birds in the form of 2800 mounted examples from the great series amassed by Edward Verreaux in Paris.

Throughout the record of all the early years, until 1888 or later, there are frequent other references to purchases, culminating in the acquisition of the great Lawrence Collection of American birds, numbering 12,000 specimens. Even allusions to gifts from friends of the Museum represent, with a few notable exceptions, indirect purchases. D. G. Elliot, however, generously turned over his own invaluable collections, and there are occasional other items concerning specimens in large part personally collected. One such tells of the receipt of the first dodo bones from Col. Nicholas Pike, United States Consul at the island of Mauritius.

In the eleventh report of the Museum, for the year 1879, we find a second stage of museum development indicated by the record of exchanges with sister institutions. One transaction included a transfer of specimens to the mutual benefit of the American Museum and the Smithsonian Institution, of Washington.

These ancient affairs are cited with the object of suggesting the steps by which natural history museums emerged from the level of morgues toward which ready-made collections gravitated and, *pari passu*, by which their scientific staffs became transformed from mere "curators" (care-takers), in the original sense, into exploring naturalists who with planned purpose go out in search of their own scientific evidence. In recent years, to be sure, the Museum has absorbed large collections brought together by specialists, but in many instances it has taken the collector along with the collection. Thus in finding space for the

Photograph by Rollo H. Beck

BIRDING IN THE SOUTH SEAS

A field worker of the Whitney South Sea Expedition, and his Polynesian guide, survey the densely wooded heights of Tahiti. In the background is a spur of the Diadem, highest mountain of this tropical isle

Photograph by H. E. Anthony

THE DECK OF THE SCHOONER "MORRISSEY"

The Stoll-McCracken Expedition northward bound for the Arctic Ocean and a walrus group for the Hall of Ocean Life at the American Museum

EXCAVATION OF A PUEBLO RUIN AT AZTEC, NEW MEXICO

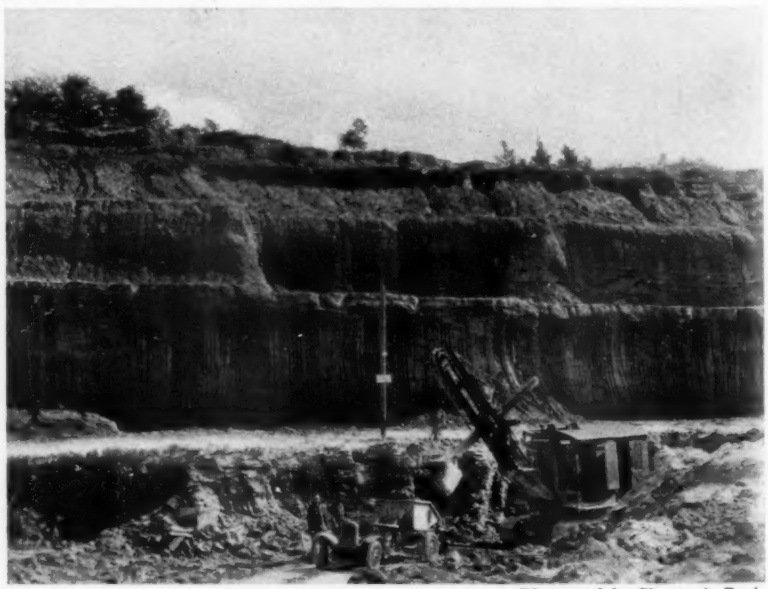
Since 1909 the department of anthropology of the American Museum has carried on an intensive survey in the Southwestern United States to recover the history of this interesting area. The work is divided into two sections, one to study the living primitive peoples of the area, the other to study the prehistoric remains

Photograph by Earl H. Morris

Dwight Collection of North American birds, and in having the privilege of adding its owner to the staff, our institution acquired not only matchless ornithological material which has since become its permanent property, but also the interest and knowledge and devoted labor of the man who through sheer zeal had brought it together.

President Osborn once expressed in the following words the changes brought by the years:

Since 1881 the American Museum has developed a policy of exploration rather than of purchase for the acquisition of collections. Although large purchases are still made from time to time, exploration is now the chief means of enriching the exhibition halls of the Museum. While specimens for exhibition are the chief aim



SEASONAL RECORDS OF THE ICE AGE

Members of the geology department of the American Museum in the clay pit at Dutchess Junction, New York. They are investigating the clay layers which were deposited seasonally in glacial lakes. These clay layers give a clew to the length of time it took the ice front to retreat northward

Photograph by Chester A. Reeds

Photograph by H. E. Anthony

ON MOUNTAIN HEIGHTS

Aconcagua, the highest peak in the Western Hemisphere. A photograph taken while the Ottley-Anthony South American Expedition was in the field collecting small mammals and making a survey for future intensive collecting in Southern South America. Aconcagua is in Argentina, and is 23,080 feet high

of the explorer, he brings back a large amount of information regarding the country visited, as well as photographs, drawings or paintings, which are absolutely essential both for publication and as accessories to exhibition. The field photographs thus acquired now number over 8000, and are in constant use in lectures and publications all over the country. In all, thirty-five parties were operating in the field during the year 1912; every continent on the globe, except Australia, has been visited, and remarkable success has crowned the efforts of the leaders, who have not only made important contributions to science but have brought rare collections from remote seas and parts of the earth.

Since these remarks were published, work in Australia has been well begun, the field photographs in our archives have increased from 8000 to 126,454, and a corresponding growth has marked

Photograph by Roy Waldo Miner

BENEATH THE SEA

One of the photographic studies for the Coral Reef Group, made through the window of the Williamson submarine tube on the outer side of the Andros barrier reef, the Bahamas. The Williamson submarine tube is the best method so far devised for obtaining under-sea photographs to a depth of 100 feet

every branch of the Museum's expansion into what might be called a laboratory of exploration. Because increase of knowledge through exploration has always transcended effort on the part of the Museum to add merely to its intrinsic treasure, the institution has shown a broad spirit of coöperation with related work not under its own control or for its direct benefit. It has, in fact, given its moral or material support, or both, and has served as a source of specialized scientific information, in the campaigns of many independent discoverers from du Chaillu to Beebe, from Peary to Byrd.

Of the ten marble likenesses of pioneers of American science thus far installed in the main entrance hall of the Museum, at least seven, namely, Humboldt, Audubon, Torrey, Agassiz, Dana, Baird, and Peary, represent men who were in a literal sense explorers. In the special assemblage of books by members of the staff, associates, and trustees of the Museum, an exhibit which has attracted much interest during the past year, it is worth noting how large a proportion are works of pure exploration. Such titles as *In Brightest Africa*, *Dragon Lizards of Komodo*, *Ends of the Earth*, and many in similar vein, tell their own story. It becomes clear from a perusal of these books that practically every modern phase of the Museum's activity is correlated with exploration. As expressed by Frank M. Chapman in NATURAL HISTORY, study collections of scientific worth may be acquired in various ways, but

> the aims of original research may best be served by sending out expeditions with definite problems in view, led by, or under the direction of, men who will attempt to solve them. A specimen is of far greater value to the man who is familiar with the country whence it comes and the conditions under which it lives, than to one who has no first-hand knowledge of these most important factors. It is, therefore, the policy of the Museum to give its curators wide field experience, knowing well that this will result not only in better collections, but in more discriminating reports upon them.

Probably the first expedition actually sent out by the Museum was that of D. G. Elliot and

Photograph by Arthur S. Vernay

GETTING INTO A "MACHAN" TO WAIT FOR A TIGER

The Vernay-Faunthorpe Indian Expedition obtained for the American Museum the greater part of the material for the Hall of Asiatic Mammals which will be opened to the public this autumn

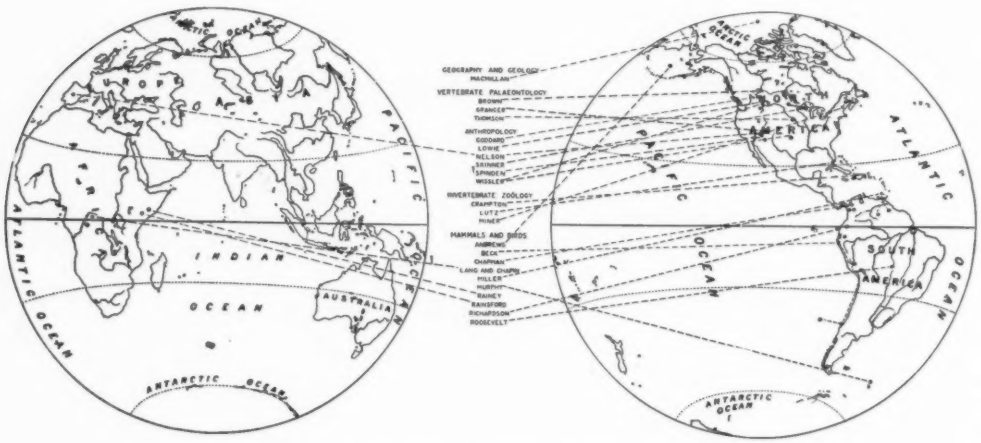
Photograph by H. E. Bradley

A MUSEUM CAMP IN THE GORILLA MOUNTAINS OF AFRICA
When Carl Akeley studied and photographed gorillas in their native haunts, he exploded many myths regarding one of man's closest existing relatives

Jenness Richardson to Montana, in 1887. This was at any rate the first field undertaking of the newly created department of vertebrate zoölogy, and I have been unable to find a record of earlier projects under the auspices of the Museum. The main object was to obtain for permanent display specimens of the American bison, then believed to be approaching extinction. In 1889, Chapman began in Florida the field work that ultimately resulted in the famous series of North American habitat groups of birds. The goal of these undertakings, and of those during many succeeding years, was frankly acquisitive, namely, specimens with which to build exhibits. It was the pioneer age of museum exploration. A long period was necessarily to elapse before field work could be thought of except in terms of carcasses; before a Martin Johnson could go to Africa equipped with batteries of motion picture cameras instead of firearms; before members of the Museum staff could spend months at a tropical island laboratory without the obligation of bringing back a skin or skeleton; before experimental work with living animals, under controlled conditions, had been dreamed of as part of the Museum's program.

Early steps in the plan of growth took us beyond the borders of the United States, for the annual report for 1890 refers to a subscription of $1,000 made by the trustees in aid of the Carl Lumholtz Expedition to northern Mexico and Sierra Madre, the objects of which were chiefly ethnographic. The next year was marked by an important mile-post in the history of the Museum when the department of palæontology began its epoch-making explorations in the Cretaceous and Tertiary horizons of the

western United States. In 1892 A. F. Bandelier began archæological studies in Peru, under the patronage of Henry Villard, and for eleven years this notable signalized by the launching of the Jesup North Pacific Expedition, one of the outstanding events in the history of American exploration. Its program included



FIELD WORK OF THE AMERICAN MUSEUM IN 1913
The location of twenty-three American Museum field parties during 1913 shown on the above map is an indication of the institution's expansion in exploration during recent years

research into the culture of the Incas and their predecessors was continued in the Andean highlands.

The report for 1893 mentions accessions added to the collections of several departments through Museum expeditions. By 1894 exploratory work may be said to have extended "from Greenland's icy mountains to India's coral strand," for the trustees largely financed the Peary Relief Expedition of that year, and during the same period dispatched Rudolph Weber to prosecute field work in the island of Sumatra. By 1896 the influence of our institution in the field of exploration had become so potent that the Mexican legislature enacted a special law authorizing the President of the Republic to grant the American Museum a concession for conducting its archæological excavations in Mexico and Yucatan. Previously, such privileges had long been denied to foreign organizations.

1897 was another memorable date, an intensive study of native peoples on both the American and Asiatic sides of the North Pacific Ocean and Bering Sea. The work was subsequently carried out by distinguished scholars, and reports relating to the ethnology of many tribes, and to their anthropological and geographic relationships, have been published during a long series of years. The investigation, in fact, is still in progress, for the final publications have not yet appeared. Only a few other expeditions of the Museum, such as those of the great period of fossil discovery in North America, and the recent work on the Central Asiatic plateau, can compare in size and influence with the project visualized so long ago by President Morris K. Jesup.

Space would by no means permit a catalogue of the Museum's explorations through the decades, but the brief list on page 465, of important representative names, the respective fields of operations and primary aims, may prove stimulating.

SOME AMERICAN MUSEUM EXPEDITIONS DURING THE LAST FORTY YEARS

Amphibians and Reptiles	Asia, North America, West Indies, South America, Central America.	Burden, Dickerson, Hassler, Marshall, Noble, Pope, Weber
Anthropology	North America, Africa, Asia, Polynesia, Arctic.	Bernheimer, Boas, Broom, Lowie, Matthew, McGregor, Morton, Pepper, Shapiro, Stefansson, Sullivan, Weber, Wissler.
Archæology	South America, Central America, Europe, North America, Asia, Middle America.	Bandelier, Hay, MacCurdy, Morris, Nelson, Olson, Schmidt, Spinden, Vaillant.
Birds	North America, South America, Oceania, Asia, Subantarctic Islands, Africa, Central America, Madagascar, Pacific Islands, Arctic, Middle America, Oceanic Islands, Polynesia.	Beck, Beebe, Bennett, Carnochan, Carriker, Chapin, Chapman, Cherrie, Crosby, Delacour, Drowne, Dwight, Ekblaw, Griscom, Hamlin, Holt, Jaques, Kaempfer, Miller, Murphy, Quayle, Robinette, Streator, Watkins.
Birds and Mammals	South America, North America, Arctic America, Madagascar, Tropical America, Africa, Siberia, Middle America, Subantarctic Islands, Oceanic Islands in Atlantic and Pacific, Europe, Arctic, Abyssinia, Asia, Mediterranean region, Australia.	Allen, Anderson, Archbold, Batty, Boulton, Buxton, Carter, Colburn, Collins, Comer, Correia, Day, Elliot, Figgins, Frick, Heller, Legendre, Mathews, McCracken, Mearns, Metcalf, Miller, Murphy, Raven, Richardson, Rockefeller, Roosevelt, Rowley, Sage, Sanford, Stoll, Stone, Tate, Tyler.
Entomology	Central America, South America, North America.	Curran, Lutz, Schwarz, Watson, Wheeler.
Ethnology	Asia, North America, South America, Middle America, Oceanic Islands, Melanesia, Arctic.	Bogoras, Goddard, Granger, Jochelson, Kahn, Laufer, Lumholtz, Mead, Saville, Skinner, Smith, Wissler.
Fishes	North America, Europe, Asia, South America, Mediterranean region, Subantarctic, Oceanic Islands.	Breder, Dean, Gudger, Heilner, Hussakof, Metcalf, Murphy, Nichols.
Geology	Asia, Arctic, North America, West Indies.	Berkey, Ekblaw, Grabau, Hovey, Morris, Reeds.
Invertebrate Zoölogy	Polynesia, Melanesia, Australia, South America, North America, West Indies. Central America.	Crampton, Miner, Van Name.
Mammals	Africa, North America, Oceanic cruises, South America, Asia, Australia, Central America, Arctic America, Oceanic Islands, West Indies.	Akeley, Andrews, Anthony, Carlisle, Clark, Faunthorpe, Goodwin, Graves, Gregory, Hatt, Heilner, Lang, Lucas, McGregor, Morden, Morton, Ottley, Putnam, Rainey, Raven, Taylor, Tjäder, Townsend, Vernay.
Meteorite Collection	North America, Arctic.	Hovey, Peary, Reeds.
Mineralogy	North America.	Gratacap, Whitlock.
Oceanography	Atlantic, Pacific, and Indian Oceans	Beebe, Murphy, Townsend.
Photography, Painting and Accessory Collecting	North America, Asia, Middle America, Africa.	Bickmore, Butler, Fisher, Fuertes, Johnson, Rainsford.
Polar Exploration	Arctic.	Hovey, MacMillan, Peary, Stefansson
Vertebrate Palæontology	Asia, Africa, North America, South America, Europe, Egypt.	Andrews, Broom, Brown, Frick, Granger, Matthew, Osborn, Sorensen, Thomson, Wortman.

In the annual report for 1907, the first from the pen of President Henry Fairfield Osborn, the principal accomplishments of Museum field work up to that date are summarized. Accompanying the text, moreover, is a world map with areas in red indicating regions reached by Museum expeditions or from which important collections had been received during that year. Such areas appear upon every continent except Australia, and also at isolated localities from the northern tip of Greenland to the southern island of New Zealand. In subsequent reports some such comprehensive plan has been generally continued. Thus

the volume for 1909 reveals that we had carried on work in thirteen states and territories of the United States, and in twenty-two distinct foreign regions. The same year marked the beginning of the great Belgian Congo Expedition, in charge of Lang and Chapin. In 1911 forty-four parties were sent out directly for the Museum, while at seven localities work was carried on for our account by local agents. In the report for this same year, Frederic A. Lucas, then director of the Museum, explained the special reason for such activity in the following words:

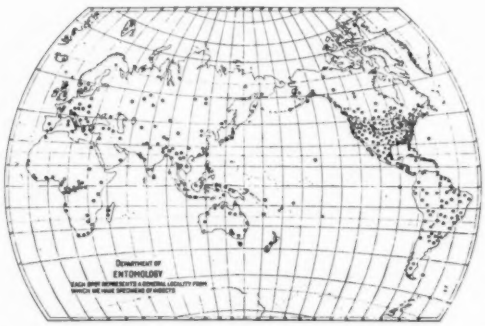


DIAGRAM PREPARED IN 1923 TO SHOW GENERAL LOCALITIES FROM WHICH THE AMERICAN MUSEUM HAD RECEIVED SPECIMENS OF INSECTS

> Realizing the rapidity with which not only animals, but races of mankind with their beliefs and customs, are being swept out of existence by what we are pleased to call the march of civilization, special effort has been made . . . to gather objects and information while they are yet to be had.

It goes without saying that effective exploration involves the expenditure of considerable sums of money, far more today than during the fortunate Seventies when, we read, an entire wing of the Museum building could be erected for "an aggregate cost of five hundred thousand dollars"! The regular resources of the Museum long ago proved inadequate to support field work, and it is to the gifts and bequests of our friends, that we have looked for financing this fundamental phase of the Museum's purpose.

In the past, fortune has sometimes smiled during periods that had promised little. In 1914, for example, the general budget of the Museum was low, and yet the recent opening of the Panama Canal pointed naturally toward a great extension of our South American exploration. At this juncture the munificent bequest of President Jesup came to the rescue, as it did again in 1916 with the beginning of intensive Asiatic exploration under Roy Chapman Andrews.

The year 1917, in which all our activities were interrupted or curtailed by the entrance of the United States into the war, was marked, nevertheless, by the placing of the capstone on the first great unit of zoölogical exploration in South America. This was the appearance of Chapman's monumental book on the distribution of bird life in Colombia which interpreted the studies of Andean life zones that had occupied six years of practically continuous field work.

By the date of the European war, American Museum representatives had made at least reconnaissance explorations in all the earth's great regions except Australia. When Gregory and Raven finally began their mammalian investigations in the island continent, President Osborn explained the need for this work, as follows:

> We are approaching the close of the Age of Mammals all over the world, but in no continent has the devastation been more rapid than in that of Australia, owing to three causes: deforestation, an enormous fur trade, and an increasing leather trade. In 1921, it became apparent that the American Museum must secure its representative collections now or never.

Today, more than ever, is the earth full of such pressing challenges. It was a realization of the fact that led to the beginning of our ornithological survey

of the Pacific islands in 1920. This comprehensive project, known as the Whitney South Sea Expedition in honor of its generous supporter, Harry Payne Whitney, is still in progress. So rapid and devastating have been the changes in parts of Polynesia during the last ten years that it is doubtful whether the early work of the expedition could ever again be accomplished, in which case our knowledge of a fascinating and highly significant island fauna would forever have been slighter than may now be possible. The discoveries resulting from this expedition will eventually be elucidated in a new section of the Museum on Central Park West.

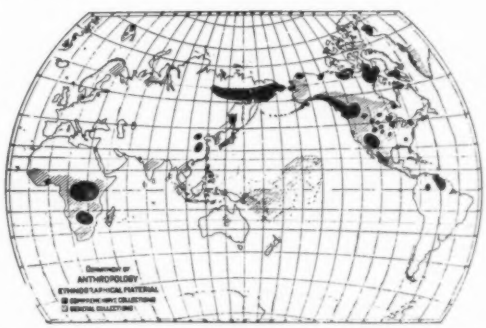
During preparation of the annual report for 1923, the curators were once again called upon for more than ordinarily detailed data on the collections of all departments. The results of this new inventory were in part shown graphically upon a series of eleven maps, two of which are here reproduced.

In more elaborate form than is possible even in the annual reports, NATURAL HISTORY has during thirty years chronicled the explorations of the Museum for its members; for a host of other readers, too, because while the circulation of this journal is relatively small, it holds nevertheless, a peculiarly authoritative position, and it is the most widely quoted periodical of its kind. It is especially interesting to browse through successive numbers in the files in order to trace the fitting sequence of Museum activities, as shown in articles, reportorial notes, and reviews, from the first penetration of some geographic field by a Museum expedition to the ultimate expression of the discoveries in

(a) Authentic press information from the Museum's own bureau of publicity,
(b) Narrative accounts,
(c) Papers read before scientific societies,
(d) Popular illustrated lectures,
(e) Technical publications based upon original research,
(f) Articles intended for laymen,
(g) Exhibits.

Some such arrangement makes the ideal cycle, from an educational point of view. Upon its consummation the way is cleared for new departures, and the specimens and photographs are added to our tangible sources of information for use in further studies.

NATURAL HISTORY likewise records various summaries of the Museum's explorations, such as the tabulation of field activities of the department of birds between 1887 and 1921, published on pages 311–313 of the volume for 1922. It would be a temptation, if space permitted, to build the present brief epitome largely by quotation from the notable list of explorers who have helped make NATURAL HISTORY. *Inter folia fructus*—including descriptions of haunting charm from many pens. Even among the contributions that are frankly suited to robust-minded readers, we frequently feel the hot, first-hand impressions of discoverers who in one sense or another have 'seen new planets swim into their ken.'



IN 1923 THE AMERICAN MUSEUM POSSESSED COMPREHENSIVE ETHNOGRAPHIC COLLECTIONS FROM THE AREAS INDICATED ON THE MAP IN SOLID BLACK, AND GENERAL COLLECTIONS FROM THE SHADED AREAS

So firmly is the Museum associated in the popular mind with exploration that the director and curators are more or less continuously besieged by applicants

who long to go, on any terms, to the far places of the earth. After one newspaper announcement of plans for Central Asiatic research, fully a thousand letters, including several score from women, swamped the office of the leader. All of these aspirants were eager; most, no doubt, were physically fit; the great majority would probably have given faithful service. But how few of them even guessed at the specialized knowledge, the intensive training, the inborn "divine effluvium" that are necessary for participating in modern field work. Exploring is not the equivalent of "camping."

It is essential that recruits should come more and more from laboratories like our own, that those who go out into the lands and waters should have their specific problems clearly before their eyes and should be equipped with the latest resources of science for attacking them. For the haphazard age of discovery is over, and exploration is no longer an end, but a means. The modern conception has been beautifully expressed by the great Scotch geologist, Sir Archibald Geikie, who has written that true geographical science is not a

> chronicle of marvellous and often questionable adventures by flood and fell . . .
>
> It now requires more training in its explorers abroad, more knowledge on the part of its readers at home. The days are drawing to a close when one can gain undying geographical renown by struggling against man and beast, fever and hunger and drought, across some savage and previously unknown region, even though little can be shown as the outcome of the journey. All honour to the pioneers by whom this first exploratory work has been so nobly done! They will be succeeded by a race that will find its laurels more difficult to win—a race from which more will be expected, and which will need to make up in the variety, amount, and value of its detail, what it lacks in the freshness of first glimpses into new lands.

Photograph by Martin Johnson

LIONS AT HOME IN AFRICA

Only the modern view of museum exploration could conceive an expedition in which studies of absolutely undisturbed wild creatures replaced the old idea of collecting specimens. Hundreds of such photographs are now in the files of the American Museum

PROBING LIFE'S MYSTERIES

Some Aspects of the Research Work of the American Museum

By G. KINGSLEY NOBLE
Curator of Experimental Biology, American Museum

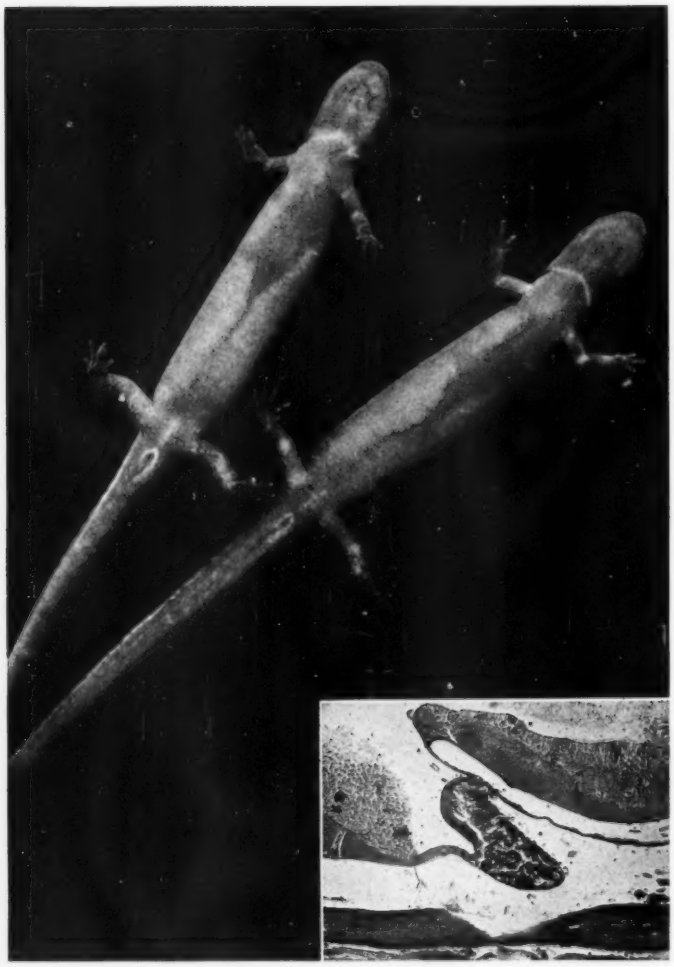
Few visitors to the American Museum realize that one of the major functions of the Museum is research, not only the identification of the many kinds of specimens which come to the Museum, but the investigation of their origins, distribution, and vital processes which win for them success in the world. The Museum employs a staff of competent investigators who are making each year many original discoveries of great importance to science. In recent years the attention of these investigators has been turning more and more to living specimens in order to solve fundamental problems which confront the naturalist and biologist. Doctor Noble, who has recently been appointed curator of experimental biology, tells in the following article of some of the work which he and other scientists of the Museum have now in hand. Experimental biology is one of the newer but more important fields of Museum research.—THE EDITORS.

AN exhibit of automobile bodies including types from 1900 to the present would be attractive and interesting, but it would in no way inform the spectator as to the evolution of the propelling machinery which has taken place in thirty years, or of the forces which have made possible this evolution. We can enjoy Nature just as we can enjoy our 1930 model without bothering to look "under the hood." Still there is a certain allurement and value in studying the machinery of life and in trying to fathom what makes the universal wheels go round. In the progressive museum, just as in the progressive automobile show, exhibits will not be confined to exteriors. Hence it happens that museum research is being directed more and more toward throwing light upon mechanisms.

Museums were invented by the Greeks and dedicated as the name implies, to the Muses of Art and Learning. Aristotle's Museum of Alexandria was a great library and home for scholars. With the enormous expansion of man's geographical horizon in the Fifteenth and following centuries, natural history museums became established as repositories for the collections of explorers and later as reference series for those who sought accurate information as to the many kinds of peoples, animals, plants, or minerals existing in the world. Describing, classifying, and caring for the collections became the principal work of the curators and has remained so until today. There is, however, a growing tendency to look beneath the surface of the material collected and to seek out basic causations with the aid of advanced biological research methods.

One might imagine that with the opening up of all parts of the world to commerce a time is approaching when all the species of the world will be known. That time, however, will probably never come. There are some 470,000 distinct species of insects recorded today and there probably live as many more which have not been captured and properly defined. Still, it is not the abundance of unknown forms which will provide occupation for the systematist for many years, but the complex nature of the species itself. America, for example, was well known geographically seventy-five years ago, but at that time only 220 kinds of mammals were known. Today more than 2500 forms have been described from the same area. One of the principal reasons for this increase is the recognition that a species is composite, consisting of many strains, some of which may be isolated geographically and hence are worthy of a subspecific designation.

Further analysis, especially by con-



THE CONTROLLER OF THE BREEDING CYCLE

The pituitary gland (lower figure) at the base of the brain produces a hormone which controls the breeding cycle of many animals. Although the eggs show through the body wall, they cannot be released until the hormone is free in the system

rôle in determining their survival. Species are built out of these units, and as many of the units are covered up, so to speak, in the process of constructing one form but appear again in derived species, the work of the systematist to be complete or final resolves itself into genetics, an experimental study of hereditary units.

There is, however, much more in museum research today than finding a name for every kind of animal or determining the units out of which the species has been produced. People want to know why animals behave as they do, why they differ one from the other. They want to know the reasons for bright colors, the reasons for protective colors—and the mechanisms whereby these are produced. In walking through an exhibition hall a museum visitor raises a host of questions which only research can answer, and research for the most part with living specimens.

trolled breeding experiments, is revealing that even these subspecies are composite groups and may be resolved into separate genetic strains. It is these strains which are the basal units of animal and plant life. Some strains are immune to epidemic diseases, others can survive higher temperatures than the bulk of the species, others are restricted to particular habitat requirements. Many strains show slight structural differences, but the physiological peculiarities play the more important

Fortunately the museum is in a unique position to answer these questions. Through its expeditions and field work the museum investigator learns to know the animals in relation to their environment. Further, he is able to secure the most significant species for working out particular problems. The museum investigator, in other words, can handle his problems without restricting himself to rats, guinea pigs, or other domestic types. A few of

the problems being attacked in the Amer- Museum laboratories may be briefly outlined as an indication of their nature and scope.

The world we know is limited by the capacity of our sense organs or deductions we may draw by bringing their messages in juxtaposition. It is obvious that the robin listening to an earthworm in its burrow must live in a world having a far different range of sounds than our own. Similarly the male moth that flies through the darkness of the forest at night guided by the odors of the female, or the bat which avoids obstructing branches by analyzing the echoes of its flight, must sense environments of which we can know only indirectly. The mystery of bird migration has often been explained by the theory that certain species require the maximum number of daylight hours and hence move into those regions which will fulfill these requirements. The hypothesis has been put to test by experimental methods. It was previously known that birds migrate when their gonads are either growing or dwindling; they remain in one locality when their sex organs are in a state of equilibrium. Rowan found that he could arrest the normal spring recrudescense of the gonads of the junco, or cause a premature midwinter growth, by controlling the number of light hours of captive birds. Further, juncos with increasing or dwindling gonads, migrated when released. Neither rising nor falling temperature had a similar effect. However, increasing the periods of com-

ON TO THE SEA
Loggerhead turtles migrate to the sea on hatching, not because of any ancestral memory but because of certain instinctive responses to gravity and to open horizons

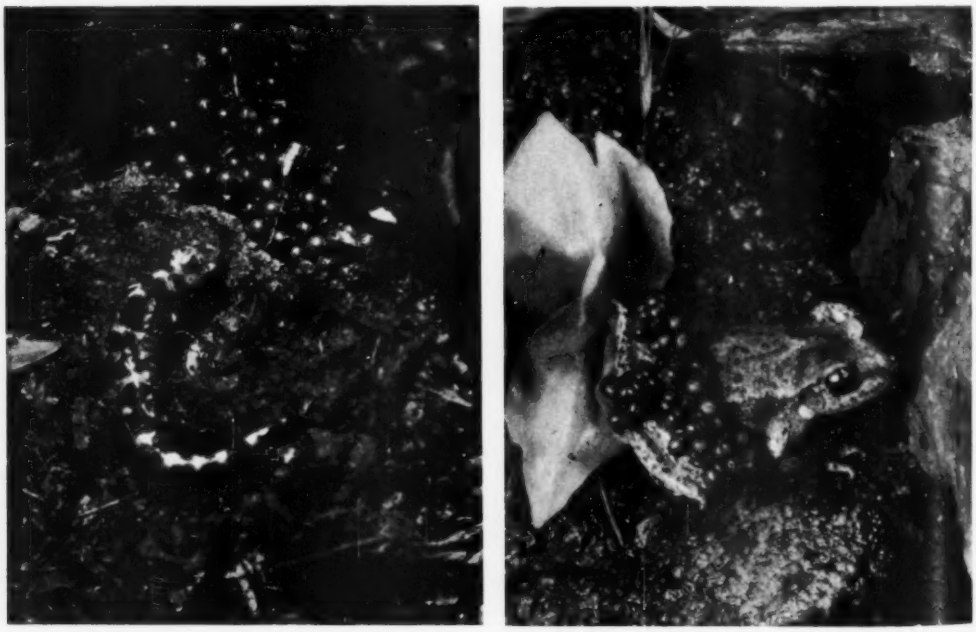
TESTING THE OXYGEN CONSUMPTION OF A TREE FROG
The distribution of animals is controlled by their physiological requirements. These can be determined only by measurement under controlled conditions

pulsory exercise produced the same result as increasing the light. It would thus seem that the length of the daily period of activity in some way influenced the gonads and hence migration.

In other groups of vertebrates the migratory impulse may be controlled by secretions from the gonads, but the latter in turn are under the control of a hormone from the anterior pituitary gland at the base of the brain. We have induced spring breeding salamanders to lay their eggs in the Museum laboratory in mid-winter by treating them with pituitary substance. Frogs, which are migratory creatures, have been made to breed out of season by the same technique. Whether or not the hormone is released by the pituitary of the artificially exercised birds is at present unknown, but surely the anterior pituitary hormone plays an important rôle in inducing the migration of many kinds of vertebrate animals.

There is, however, another aspect to the problem of migration, namely the specific cravings of a hormone-activated frog or bird. Newly hatched turtles migrate to the sea because they inherit a certain combination of sense organs, nerves, and muscles, which forces them to move down hill and away from an obstructed horizon. If the horizon near the sea is experimentally blocked, the turtles move inland, as Parker showed. The migrating turtle has no "ancestral memory" of the sea and it is doubtful if young birds migrating to the south for the first time are directed by any knowledge of the delightful winter resort which awaits them. The sensory data which orient a migrating frog are probably not those which orient the bird. However, the desire to move during periods of gonad growth is a very old one among animals.

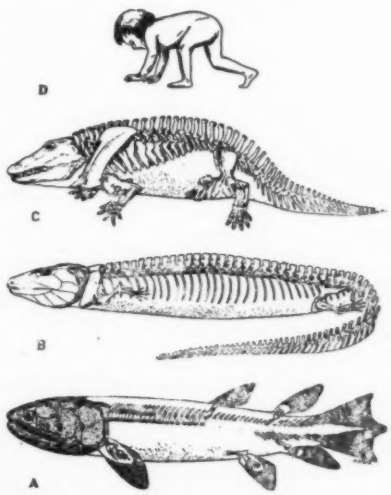
Animals do not foresee the use of their



THE EVOLUTION OF THE BROODING INSTINCT

The female marbled salamander (left) remains with its eggs merely through exhaustion, but this habit has the advantage of keeping the eggs, which are laid on land, from drying. In some other Amphibia, such as the mid-wife toad (right), an instinct to take care of these eggs has become established

habits. The mother marbled salamander remains with her eggs merely through exhaustion. The habit, however, has the advantage of keeping the eggs moist, and in other Amphibia which lay their eggs on land, this habit has become established as an instinct. The male midwife toad carries the eggs wrapped around his legs until they are ready to hatch. In some higher vertebrates the instinct to care for the young may dominate all the others. In the vertebrate series various instincts appear at certain stages and gain ascendency now in one group, now in another. The desire for territory appears during the breeding season in fish and becomes an important part of the social organization of birds. Very little is known about the organization of lizard colonies, but plans are under way through the coöperation of Mr. Gilbert C. Klingel to take up this field of investigation in the West Indies. Universities have organized expeditions solely for the study of behavior in various groups of animals. The important results obtained warrant further work in this direction.



RECONSTRUCTING THE TREE OF LIFE
The fossil record discloses the to Dr. W. K. Gregory the principal steps by which certain primitive fish were modified to form the first land vertebrates, with their great potentialities for future evolution

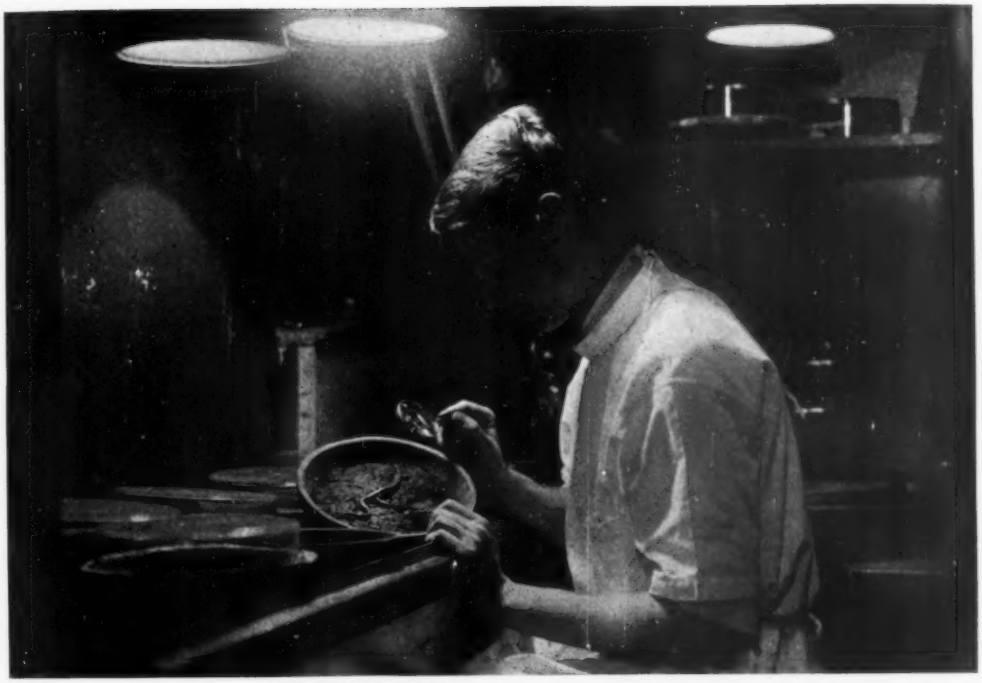
Only a very few kinds of animals live in colonies or have developed a social organization, but all species form more or less important links in food chains. While plants can stand in one place and manufacture their carbohydrates out of the air and water, most animals, being devoid of chlorophyl, must obtain their carbohydrates from plants or secure them once or more removed from the source by preying on other animals. Plants are built to expose broad surfaces to the sun,—their source of energy for carbohydrate manufacture. Most animals having to move or starve, are bilateral with food detectors,—the sense organs,—clustered about the food trap at the forward end. The form of the food trap, sense organs, and locomotor apparatus is closely correlated with the speed of movement and kind of prey. It is not mere chance that submarines have the form of some pelagic fish, and that speed aëroplanes resemble certain fast flying birds and insects. There are certain mechanical conditions which make for efficiency in rapid progress through water and air. Nature has met these conditions and the engineer has much to learn

BASKING IN THE WARMTH OF AN ULTRA-VIOLET LAMP

Lizards to behave normally must be kept in the pink of health. The Haitian lizards shown here receive fifteen minutes of exposure to ultra-violet a day

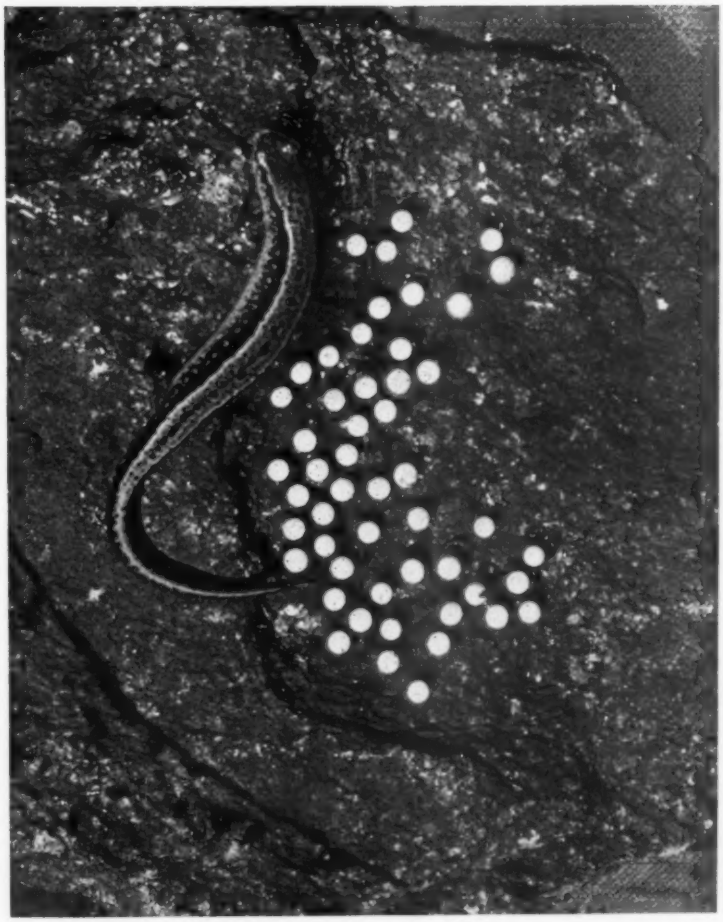
A RED-HEADED SKINK INVESTIGATES

During the courting season the male redheads are very pugnacious and fight with every lizard they chance to meet. The bright colors of most male lizards serve as warning rather than attracting devices during courtship



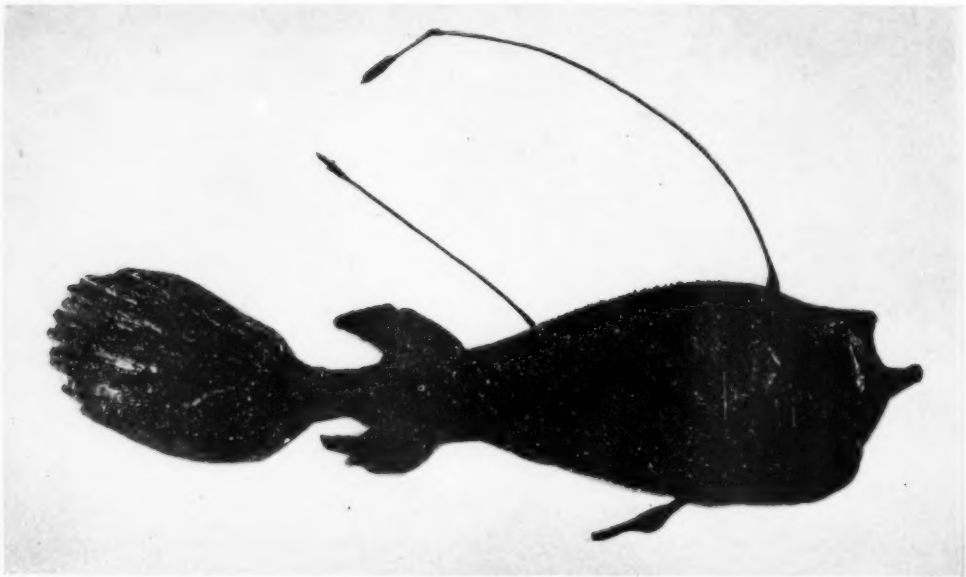
ANALYZING THE COURTSHIP OF SALAMANDERS

Under the controlled lighting of the dark room the elaborate courtship of many rare salamanders has been studied. The male slimy salamanders shown above have a skin rich in hedonic glands, the secretion of which attracts the female during the courtship antics

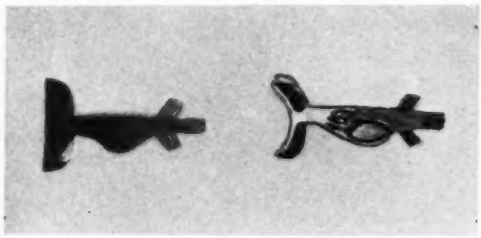


THE RESULT OF AN EXPERIMENT

The southern two-lined salamander lays its eggs in clusters or singly attached to water weed in North Carolina swamps. When females were given the choice of water weed or stones, they selected the latter and reverted to the primitive manner of attaching their eggs to the under surface



In the deep-sea angler fish the males are parasitic on the females and become permanently attached to them as inconspicuous appendages. Their digestive organs dwindle as shown in the model on the left. The male in the upper figure is the small appendage attached to the ventral surface of the female angler



A PARASITIC MALE

from her. The study of animal mechanics has long held the attention of Museum investigators, while the analysis of food chains, the principal work of the ecologist, relies to a large extent on the field reports of Museum naturalists.

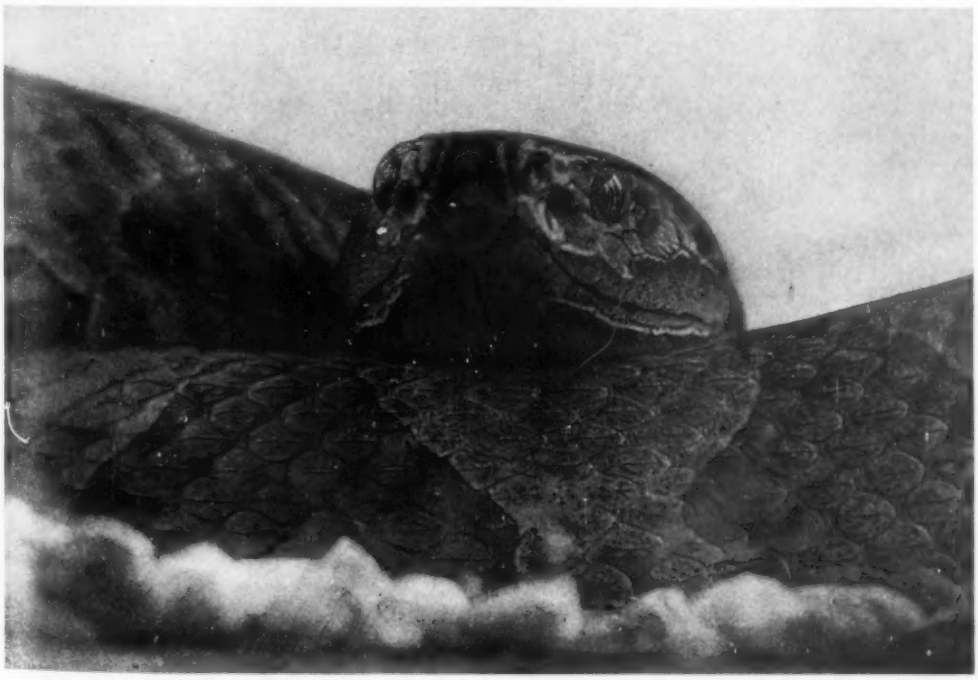
All animal life to survive must live in harmony with some particular environment. This indirect relation of an animal and its environment may leave its impress on later generations. During Devonian times, for example, a premium was placed on the development of lungs in certain primitive fresh-water fishes which inhabited pools subject to rapid dessication. The increase in the lungs necessitated a remodeling of the circulatory system and a profound change in the heart to pump blood in need of oxygen directly to the lungs. The heart of land vertebrates, including man, owes its ground plan of structure to the idiosyncrasies of a fickle Devonian climate.

To appreciate other distinctive features of animals it is often unnecessary to look beyond conditions existing in nature today. One frequently wonders why there are so many beautifully colored creatures in the world. Do the bright colors of male birds have any significance? Have they come into existence as the result of generations of choice, each female tending to mate with only the more splendidly garbed males? In spite of many years of field work there are only one or two convincing series of observations which would confirm this conclusion.

On the other hand tropical lizards, which often vie with the birds in their absorbing beauty, have been imported to our Museum laboratories and studied under ideal conditions for observation. Here it has been found that bright colors are employed merely to bluff possible rivals into avoiding encounters with their owners. Bright colors in birds may in some instances be alluring devices, but in lizards the female usually has no choice in the matter of selecting a mate.

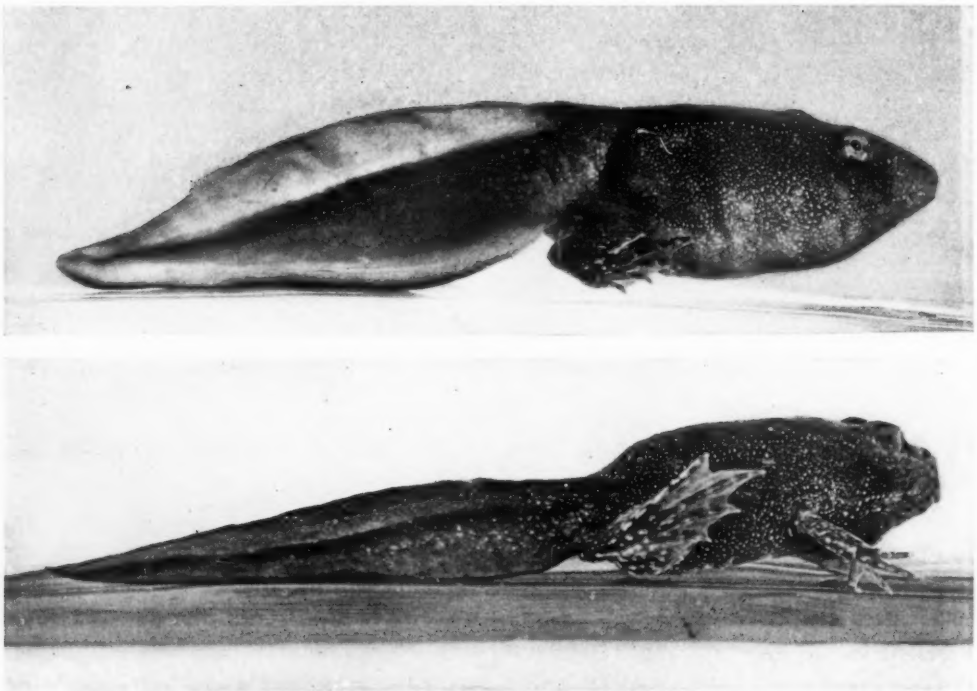
Similarly, the grotesque, subjected to laboratory observation, has yielded information which could not have been determined in the field. Many common salamanders have the front teeth in the upper jaw of the male protruding well beyond the mouth. Under the controlled lighting of the dark room it was found that the males use these teeth in stimulating the female during the first phase of their elaborate courtship.

There are many other peculiarities among well known animals which still await explanation. Until recently the "four nostrils" of rattlesnakes and other crotaline snakes seemed incomprehensible. The posterior pair of facial orifices have a membrane stretched across their lumen but this serves neither as a smelling nor hearing organ. Evidence has been worked out in the Museum laboratories indicating that this structure is a tactile organ adapted to record air disturbances produced by passing enemy or prey. Air waves impinging on the membrane direct the strike of these deadly serpents. Snakes are notoriously deaf creatures, and as some are active at night, refined tactile organs would be a decided advantage in capturing their food. The work on the



THE FACE OF THE COPPERHEAD

The lower facial orifices of the copperhead are not extra nostrils, but delicate tactile organs for detecting air vibrations. They apparently serve to direct the strike of most of the poisonous snakes of the New World



PART OF THE MECHANISM OF METAMORPHOSIS

The front legs of the tadpole develop under the skin of the neck until a time when a secretion released by the degenerating gills digests a pair of holes through which the limbs make their appearance. The tadpole shown is that of the rare southern bullfrog, *Rana heckscheri*

senses of serpents is still in progress in the Museum.

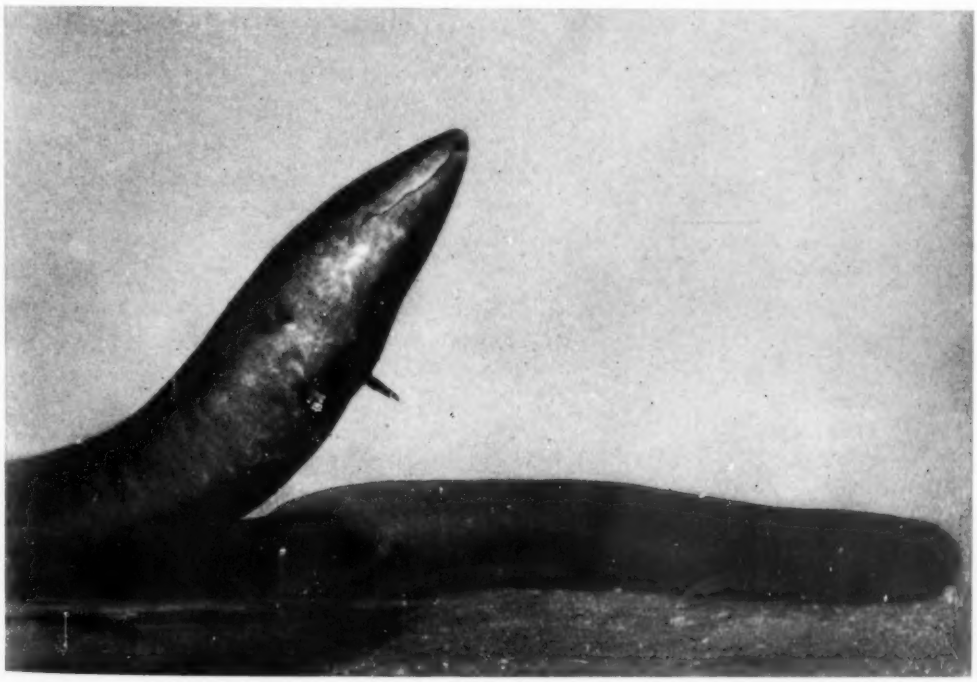
Not all species of animals can be subjected to experimental observation, and many questions concerning them are bound to remain unanswered. Recently it has been shown that the male deep sea angler fish shortly after hatching, seeks the female and bites into her body or head. The lips and tongue unite with the skin of the female and the husband becomes an insignificant appendage on his wife. Now, fish are highly organized creatures and it is remarkable that such fusions could occur.

Still more remarkable is the claim that the blood stream of the female is continuous with that of the male. The sex of an animal although determined at the time of fertilization by the factors in the chromosomes may be altered or reversed by the hormones of the opposite sex. Salamanders have had their sex changed in both directions by hormones of more mature gonads of the opposite sex transplanted into their bodies. Many Amphibia may pass through a prolonged neutral stage before the gonad develops into an ovary or a testis, and during this stage hormonal or even temperature effects may bring sex reversal. Hence it is something of a mystery why the male appendage can retain its masculinity if its tissues are really bathed with female blood.

The parasitic dependence of the male on the female is obviously of advantage in keeping the pair together in the inky blackness of the deep sea. A description of any adaptation gives no clue as to the

causes which have produced it, and the same may be said for even the small differences between species. It was recently found that wallabies introduced sixty years ago from Australia to an island near New Zealand have today longer and silkier fur than the same species in Australia. Whether this change was the direct result of the environment producing its effect during the growth of the first generation, or whether some germinal change has appeared in this isolated stock can only be determined by experiment. It would seem that the latter was the more probable. If we inbreed a few specimens of a species, strains will tend to become purified and show themselves merely because there is a better chance of like variant combining with like under such conditions. For the same reason, when birds, reptiles, or other creatures become isolated on islands, they rapidly diverge from the mainland stocks.

Not only the real nature of species differences but also many other problems of the naturalist can be solved only by experiment. Let us take an example from but one department of the Museum. It has recently been established that the mode of life history of a frog or salamander frequently gives good evidence of its relationship. In the coastal plain of southeastern United States the two-lined salamander lays its eggs singly or in small clumps attached to water weed or débris in the small streams. The northern race of the same species holds to the more primitive method of attaching its eggs singly to the underside of a flat stone. In the region where the former race occurs there are no flat stones, and the question arose: Might not the egg cluster method be a makeshift arrange-



THE CONGO "EEL"

Amphiuma is not an eel but an aquatic salamander which has begun, but not completed its metamorphosis into a land form. A partial metamorphosis has been shown experimentally to occur in several other giant salamanders

GALAPAGOS FINCHES

Four species of Galapagos ground finch (*Geospiza*) of the same sex and taken from the same island. Since all these finches eat approximately the same food, the marked difference in bill shape is in no way correlated with their habits

ment which would be abandoned if the salamander lived in a more favorable environment. When several southern salamanders were given their choice of laying their eggs among water weed or attached to rocks they reverted to the primitive method as shown in the photograph on page 475.

Many kinds of data may be utilized in studying relationship. In recent years the existence of "blood groups" has been demonstrated in all races of mankind. The only other animals which possess corresponding group reactions are the anthropoid apes. This in itself may be taken as important evidence of man's relationship to lower forms. There are, however, other methods of blood study which may be profitably employed on anthropoids. A study of blood relationship by serological methods has recently yielded important results, and the Museum with the help of Dr. Alan Boyden has recently taken up a program of investigating the relationship of Amphibia by this method.

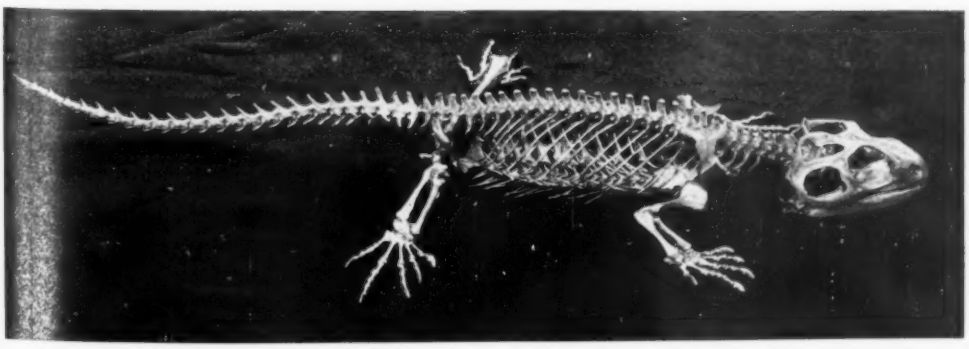
With the increasing use of living material in the Museum, various investigators have been attracted from other institutions to study special problems. For example one of the more spectacular phenomena in nature is the sudden color change which many fish, lizards, squid, and a few other types are able to undergo. This is brought about by the contraction or expansion of the pigment cells. If a piece of skin of a chameleon is isolated from the body, the pigment cells may still respond to changes in illumination. Dr. C. E. Hadley, a Museum guest, has recently made use of Museum material in working out the various influences, nervous and hormonal, which control the movement of these cells in the living animal.

The scientific staff of a museum is usually organized into departments which are held responsible for knowing the classification of certain groups of animals. This is essential for the handling and

identifying of the large collections which come to a museum. The curator is frequently called upon to account for the distribution of the species he studies. With the increasing use of instruments of precision, the oxygen, temperature, humidity, and other requirements of any species may be worked out, provided the specimens are brought back alive.

The presence of living material in the laboratory invites the investigation of fundamental processes which are common to many groups of animals. To take but one further illustration, in lizards and birds molting may occur at regular intervals, while in Amphibia environmental influences may have a profound effect. It would seem that the mechanism controlling the molt must be the same throughout vertebrates, and investigations are under way in the Museum to determine what this mechanism might be. Evidence that it may be hormonal in nature has been obtained for certain groups.

Comparative studies strongly suggest that the glands of internal secretion, the endocrine organs, have played an important part in the evolution of many groups of animals. We have tested one small corner of the field experimentally. The giant salamander and congo "eel" are purely aquatic salamanders which retain some of the gill apparatus of larvæ. The question arises: Are these strange creatures degenerate young of some formerly terrestrial salamanders? Cretinous children if treated with thyroid grow into normal human beings and why should not the salamanders grow up?



NOT WHAT IT SEEMS

The *Sphenodon* or Tuatera is not a lizard but the only surviving representative of the reptilian order Rhynchocephalia, a group of reptiles more closely related to the crocodiles than to lizards. Various features of the skeleton, such as the bones of the temporal region, reveal the reptile's true identity

Although the treatment brought a rapid metamorphosis in the skin and a few other structures, the animals failed to change into land forms. Nevertheless, the result was interesting in showing how an animal may become adult in one part of its body and yet remain juvenile in another part.

During development the secretions of tissues which are not endocrine organs may enormously affect an adjacent part. At the time of metamorphosis, for example, the pollywog does not thrust out its forelimbs which have been growing under its throat skin, but a neat hole is digested through the cover for each forelimb by the degenerating gills of that side. This was first demonstrated by Dr. O. M. Helff, an associate of the Museum who has been coöperating in its research program. The processes of development are very complex, but such progress in their analysis has been made in recent years that an increasing number of investigators in universities and medical schools are being attracted to the field. Since the differences between animals first come into existence during development, the immediate cause for the difference must be in the developmental processes. Why, we may ask, should the Galapagos finches exhibit such a diversity of bill form when they live in the same place and eat essentially the same food. Obviously internal processes are molding these bills, but their nature has not yet been determined.

The advance of biology resembles the growth of a tree in that while branches may be thrust out in all directions there are certain zones of growth near the apex which carry the tree upward. These zones of growth lie today in the experimental approach to problems of species, structures, and functions. The grandeur of the theme of life, its multitudinous variety, makes the task of isolating any essential components difficult. The Museum with its many opportunities for securing the significant material is in a unique position for advancing biological progress. The work depends for its support on the generosity of public-spirited Museum friends who are glad to see unravelled at close hand some of the mysteries of life.

BIOLOGICAL DIAGRAMS

The principles controlling the origins and functions of animals have an important place in exhibition halls. Biological diagrams, such as those mounted along the walls in the Reptile Hall of the American Museum, represent the results of research in many institutions and are eagerly consulted by students

Group of Indian tiger for the new South Asiatic Hall

SCIENCE, ART, AND ADVENTURE BEHIND MUSEUM EXHIBITS

The Many Phases of the Work of Preparation and Installation of Materials Collected for Exhibition Purposes — The History of Life as Portrayed in the American Museum Exhibition Halls

By JAMES L. CLARK
Assistant Director, American Museum, in charge of Preparation

THAT the natural history museum of today is increasingly attractive and increasingly recognized as a community asset is due in large measure to a revolution in the display of museum material, which has taken exhibits out of the depressing sawdust doll class into the realm of art, and added alike to their appeal, their scientific exactness, and to their educative value. The revolution, in which the American Museum of Natural History has been a world leader, has been apparent to museum visitors, but the meticulous and incessant creative labor that has made it possible is unknown except to the initiate who has gone "behind scenes." This is the labor of love performed by the department of preparation, which makes ready for the critical eye of scientist and lay public alike the American Museum's acquisitions of material from the field.

It is a popular misconception that a museum is unchanging and unchangeable; that specimens are collected, "stuffed," mounted, and given an assigned post in perpetuity. The impression is common that with extensive collections once placed on exhibition, the museum is finished and needs only upkeep.

How different is the reality,—continual change! Improved methods of preparation and presentation are ever being devised, while the more exacting standards of exhibition alluded to make the mediocre unthinkable and set higher and

higher goals. Meanwhile in the limitless field of nature are found almost daily new specimens to bring collections just so much nearer the completeness that is aimed at but never quite reached. Identification of new species and new phenomena, whether of today or of 50,000,000 years ago, brings to recognition new sets of facts. Research, study, and the grouping of these, bring new scientific conceptions or reassigns scientific values. With these gains the museum must keep step in what it displays, or break faith with the public that looks to it for authoritative guidance.

It follows then that the work of museum preparation is extensive, exacting, and never at an end. Nor is variety the least of its attributes. Its tasks range from the modelling of a microscopic organism to the reconstruction, in life size, of a whale, through all the ages the largest animal. Between amœba and leviathan lie vast worlds of creatures, the preservation and proper exhibition of which in the American Museum engages the full-time services and utmost cunning and ingenuity of more than fifty men and women—artists or superior artisans every one. And to supplement their services with structures and casings the Museum's department of construction must be called upon for resourceful workers in metal, wood, concrete, and stone.

But there is no more convincing evidence of the extreme thoroughness and artistic zeal wrought into the Museum's preparatory work today than the fact that making habitat groups ready for display usually costs as much as the expedition which collected the material in some remote quarter of the globe, and often takes much more time. Indeed, with funds for this work restricted, the Museum has had to decline offers for the financing of specific expeditions, unless an

MAKING A GROUP MODEL IN THE FIELD

James L. Clark, the author, designs and executes his sketch model of the lion group for the African Hall, while encamped in the very land of the lion

Photograph by James L. Clark

A FIELD STUDY FOR THE SCULPTOR-TAXIDERMIST

The actual material is but a small part of a successful group. First-hand information is inspiring and imparts an equal contribution to its success

equal sum were made available to care for the exploring scientists' specimens. For the same reason the Museum has had to decline offers of desirable material.

Time was when museum preparation—to speak specifically for the moment of mammal groups—went little beyond common taxidermy. Animals were frankly "stuffed." (Indeed, who does not remember the old exhibit whose seams finally parted to reveal the "stuffings?") Skins brought to the museum were packed with excelsior and other material, and the resultant "animal" was generally mounted stiffly erect, often with no hint of his natural attitudes, and certainly with no appropriate background or surroundings. The subtleties of form, the rippling of muscles under the skin, all the evidences of power and grace without which the animal cannot be truly visualized, were missing. But taxidermy has given way to veritable sculpture supported by innumerable arts and crafts and controlled by infinite sketches and measurements, protracted observations in the field and the evidence of the camera as well as of the eye. Preparators and artists of the department of preparation accompany the scientist explorer, half around the globe if need be, to gain the data and accessory material with which alone a habitat group can artistically display the animals as they actually are, in a section of their natural home as it actually is.

The advantage of participation in the collection of material and data by the men who are to prepare groups is obvious, but there is an even greater intangible gain. No one could possibly recreate these beasts, as they are found in their native ranges, unless he had seen and studied their rounded, subtle forms under all normal conditions of their daily life. Nor could an artist paint the superb backgrounds which enhance all recent groups,

STUDIES OF EUPHORBIA TREES AND ROCKS

Such bits of nature offer fine background studies for groups, and are typical settings for animals that live in the same locality

A LIMB OF THE EUPHORBIA TREE

Detail photographs, casts, and color notes are taken even of trees so that the accessory men may have data for their reconstruction

AN AFRICAN LANDSCAPE
Numberless beautiful vistas almost bewilder the collector in his selection of the best background for his group

PREPARING A LION SKIN
Special tools and preservatives must be taken into the field to insure proper care of all material until its arrival at the American Museum

Photograph by James L. Clark

W. R. LEIGH WITH SPECIMENS OF PLANTS
Mr. Leigh has accompanied two American Museum expeditions to Africa for the sole purpose of getting color studies of plant life and for backgrounds

unless he, too, had seen and absorbed the spirit of the veldt, of the jungle, or of the desert in which the animals roam. The modern group fails unless it imparts the living sense of beauty which inspired the museum men in the field itself.

So it is that our work starts, not in the studio, but in the field, and generally with more than one single representative of the department—for several must work on the group and much that is seen can never be imparted. If the expedition is objective—planned to obtain a certain group rather than to explore—the general design often is well in mind even before the field is reached. Accordingly there is no random taking of specimens. Every animal that comes within range is carefully scrutinized as to sex, age, condition of skin, and various phases of coloration or character.

Immediately the selected specimens are shot, each item of information that will assist in reconstruction in the American Museum studios thousands of miles away is permanently recorded. In the most recent instance, some seventy tape measurements were made of a tiger. Almost endless details are recorded in sketches, and casts are often resorted to. Meanwhile the camera has been making its own record, not only of the animal taken, but of his brothers and sisters in life. Even the movements of the beast, it is almost needless to say, can be and generally are recorded by photography—to remain as a permanent check on the naturalness of posture which the preparator today insists upon.

Actual preparation work—in the care of the pelt, bones, horns, etc.—of course has to start on the spot, and often entails the most intensive day and night applica-

Photograph by James L. Clark

THE FLOWER OF THE "SANSEVIERIA"
A detailed photograph of the plant shown in the upper picture. Such pictures with sketches and preserved specimens show the accessory man the formation of the flower cluster

tion to guard against damage and to insure preservation till the shipment, perhaps months later, reaches the tannery and other workrooms of the Museum. Meanwhile the preparators will have been busy in other directions. There will have been selected a representative section of the animal's habitat that will lend itself to framing into the foreground of a habitat group. By pencil, brush, and camera this is recorded with utmost accuracy as to composition and form. The artist makes sketches of the foliage and flowers; selecting a suitable and typical background, he spends days in transferring it to canvas. Thus are recorded completely the form and color of animals and their immediate and remote surroundings which will guide the preparators during the months of work to be done "back home."

But the expedition will also bring back

Photograph by James L. Clark

GROUPS OF PLANT LIFE AND ROCKS

No one could possibly conceive such a beautiful arrangement of color and form. Only nature produces them, and seeing them in their natural setting insures preserving all their original charm

Photograph by James L. Clark

THE SPOTTED ALOE

From among the groups of plant life usually one is selected with its flowers from which to make plaster casts, while another is preserved intact

preserved in many ingenious ways, the "accessories". (See "The Accessory Man and the Museum group," by A. E. Butler, NATURAL HISTORY, Vol. XXX, No. 3.) Bushes, grasses, flowers, tree trunks, and samples of soil and rocks are carefully selected and transported back to New York, so that the finished group may be made up entirely of material obtained in the field and of cunningly fabricated material based with exactitude upon it—even to individual leaves and buds.

Some of these "accessories" are dried and used as they are—but green leaves, flowers, and fleshy plants must be reproduced in wax, glass, celluloid, or other suitable materials, while rocks generally are made of plaster matching the sample in color and texture.

While the skins are being tanned to a soft and durable flexibility, the modelling

MR. LEIGH PAINTING A DETAILED BACKGROUND STUDY

In the wilds, the artist sitting quietly intent on his work may not be aware of rhino or leopards coming up from the rear. He must, therefore, always be guarded by a boy armed with a gun

R. C. RADDATZ MAKING PLASTER CASTS OF SELECTED LEAVES

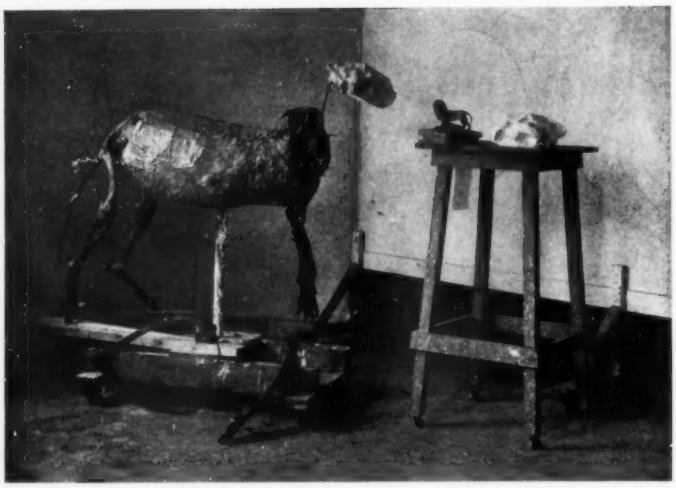
Often a small "shop" must be set up in the field that the varied material may be properly handled while it is still fresh

IMPALLA IN AN ACACIA FOREST

An inspiration for a group. What artist could paint these exquisite tree forms unless he had actually seen them. The reproduction of such gems makes the American Museum groups unique

A BED OF "SANSEVIERIA"

From this photograph the accessory man reconstructs the bed in the group, using the specimens shown on page 488



AN ANIMAL IN THE MAKING

This and the following eight pictures show the stages in the mounting of a lion. A rough frame supported on an upright carries the leg bones and skull on which the clay is built up

of the animals begins. Here the medium usually is clay, which can be and is handled with the artist's touch despite the necessity for incessant check with measurements, photographs, and sketches. The objective is the reverse of tailoring—the modelling of a body to fit the "garment," in this case an animal skin. The model satisfactorily completed, a plaster cast is made, inside which are built up layer by layer sections of maché and wire mesh which are later joined. This thin but enduring shell or manikin, when removed, exactly duplicates the clay model. Upon this manikin is applied the tanned skin.

Meanwhile, in a broad recess in the wall of a proposed exhibition hall, the foundation will have been laid, the rock work set, and the larger trees and other objects put in their determined places. The artist, with his field sketches, and a vivid memory of field observations, is well along with the broad panoramic painting which will be the background for the whole scene and provide its general atmosphere. And in half a dozen workrooms the artisans in glass and wax and fabrics have been producing in infinite detail leaves, flowers, and all the hundreds of nature's smaller bits that lend conviction to the whole. Among these birds of the region are sometimes depicted. It is an interesting fact that birds remain the one large classification of Museum specimens for which the time-honored "stuffing" technique has not been excelled.

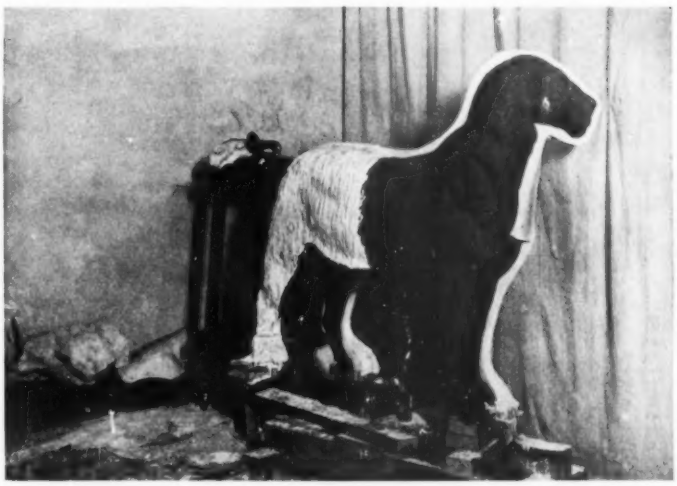
When all is brought together in accordance with an original sketch model, the lighting worked out, and the great

THE LION TAKES FORM

The author sculpturing the anatomy of the lion as it would be without the skin. Note the care with which the muscles have been worked out. A plaster cast of a lion's head and shoulder taken in the field rests on the floor at the lower left

plate glass window sealed into place, we have a habitat group which is literally a section of pulsing wild life transported almost bodily from the field.

The habitat group, however, is not built and put on exhibition with the promptitude that the news announcement, "the expedition brought back valuable specimens," etc., brings to mind. The public inevitably has to wait from three months to three years for the completion of the intricate work involved. Further, the drying and curing of various materials enforces frequent waits, which are utilized to advance other groups. So many groups and so many tasks on other specimens are always in progress that the department generally wonders how, without more hands, it can accomplish the work asked of it.



MAKING THE PLASTER MOLD

The model completed and the skin tried on to insure the fit. One half of the model is shown already molded, while the other half has been partly applied

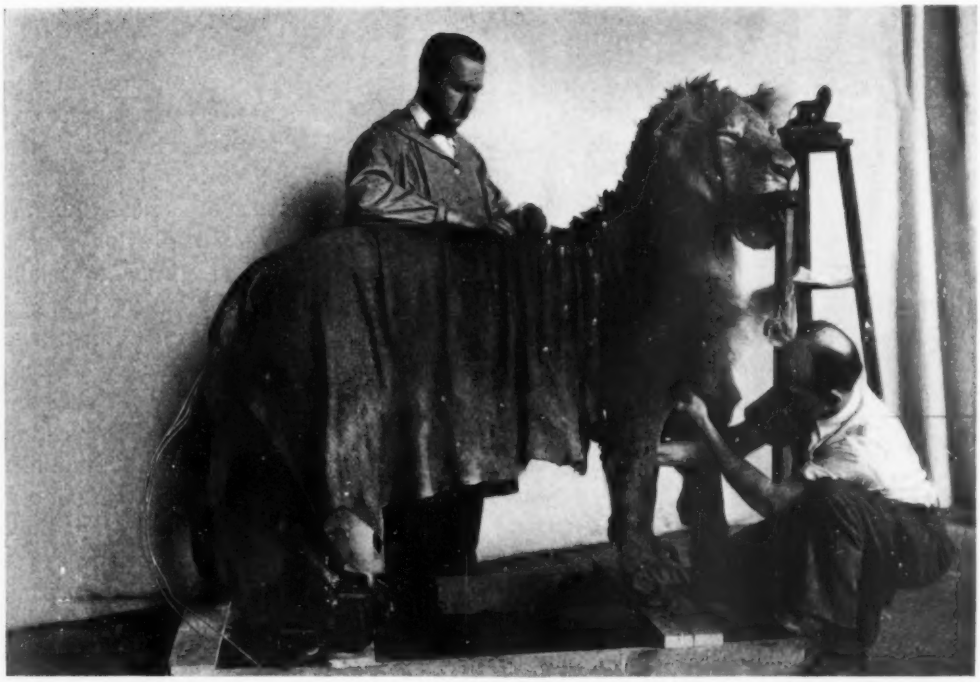
The sculpture method in use in the preparation of mammals has been found applicable to large animals; yet for elephants, rhinoceroses, and similar hairless, heavy-skinned beasts, other techniques must be used. Probably the most successful has been the method devised by the late Carl Akeley upon whose artistic skill, zeal, and ingenuity depends so much of the modern improvement in preparation, and who, like Dr. Frank M. Chapman, curator-in-chief of ornithology, was one of the pioneers in establishing the habitat group idea in this Museum. By this method, to state it briefly, the body of the animal is shaped on a frame which is covered with soft clay. The thick hide is laid on to the moist clay and the convolutions pressed into it. With the

THE MOLD COMPLETED AND PARTLY REMOVED

One half of the mold has been removed and is resting on the floor. As the second half is the larger, it is necessary to break up the clay model before this part can be removed. It is inside this mold that the manikin is constructed

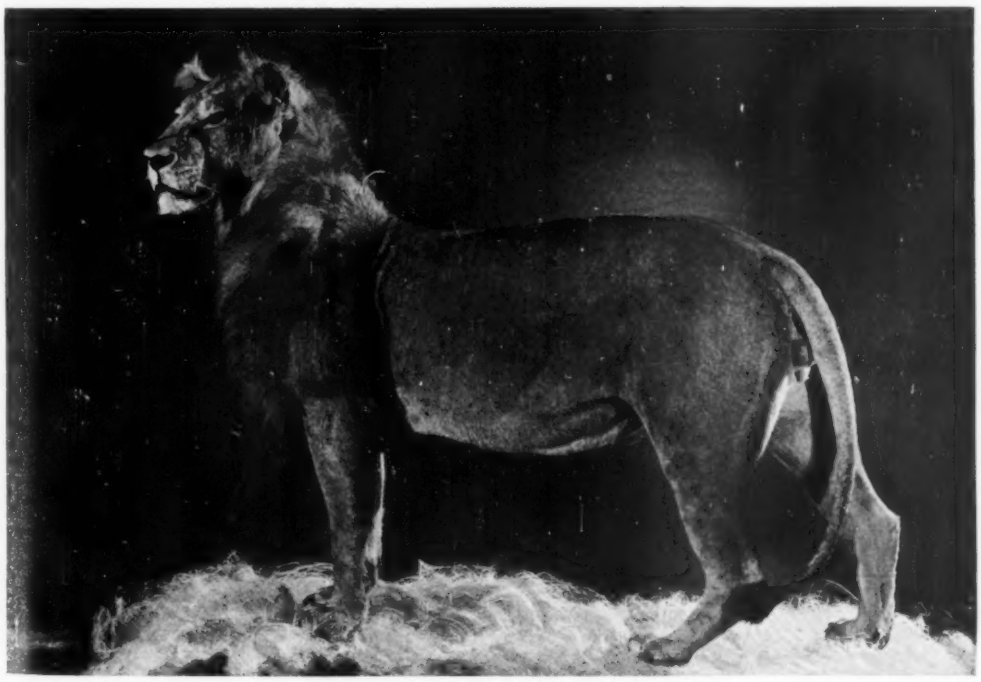
MAKING THE "MANIKIN"
The mold carries the form, and into this is constructed layer by layer sections of papier-maché and wire mesh to form the manikin

REMOVING ONE HALF OF THE COMPLETED MANIKIN
The manikin, a thin shell not more than one-eighth of an inch in thickness, is reinforced with half-inch wooden ribs, and then removed from the mold



APPLYING THE SKIN

The skin, which has been tanned into a soft, permanent leather, is dampened and applied with an adhesive to the manikin and arranged in all its details before it is allowed to dry



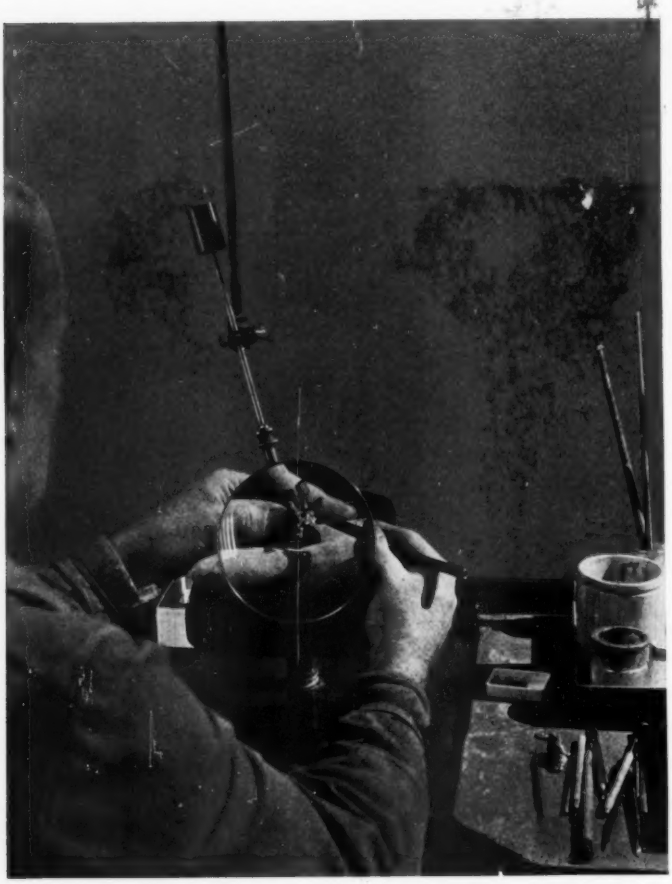
THE COMPLETED SPECIMEN

Strong, permanent, and lifelike—a product that has involved more work than if it had been sculptured in bronze

aid of field notes, sketches, and photographs, the body takes its final and correct shape from the hide, which is the reverse of the method employed with the hair-skinned animals.

There are, however, limits to the application of either of the above methods. Modelling a whale in clay or even preserving the "skin" would be impracticable. Accordingly the whale is represented in a built-up model exact in measurements (made from an individual specimen) and in coloration. Sharks and smaller finned creatures may be modelled from casts or measurements and the skins used over the model.

Interesting phases of preparation which have reached high development at the American Museum are those supporting the exhibition and research work of the departments of palæontology and lower invertebrates. Palæontological preparation, dealing with fossil remains of prehistoric creatures whose probable weight might range from a few ounces to many tons, has little in common with the preparation of extant animals. It may involve the gradual exposure of a skeleton or a clutch of dinosaur eggs by picking surely and patiently with a needle-like instrument at a block of sandstone shipped home from the Gobi desert. Or it may entail six months' trial of patience, eyesight, and skill in gradually piecing together under a magnifying glass from thousands of random fossil fragments the skeleton or a few bones of an animal previously unknown. This pursuit probably has no counterpart except in the cut-up picture puzzle, but is a vastly more trying game because it is played in three dimensions instead of one, there is no picture or model to go by, and pieces are inevitably missing. The preparator in this case must have extensive knowledge of present and past bone structure and anatomy. Eventually the skeleton appears in the exhibition hall or the study collection so perfectly restored as to give the impression that it was found that way.



THE PREPARATOR'S VARIED WORK
Otto Falkenbach turns his hand to restoring a minute fossil

As much a trial of patient skill is the modelling of invertebrate life,

especially the organisms which are so tiny as to be ordinarily invisible but are seen to take grotesque or beautiful but involved forms when magnified. In all their translucent intricacies these strange bits of living matter are exactly reproduced, even to color tints, by artists specializing in glass, wax, and other media, so that the visitor has under the naked eye hundreds of specimens which otherwise only the microscope in expert hands and in many exotic places could show him. Here, too, are prepared for exhibition corals, sponges, and many other marine growths—often with much of their substance intact but with their colors and life textures restored by the artist, who perhaps has descended fathoms under water in a windowed steel tube to make his color notes.

H. O. MUELLER WITH HIS GLASS-BLOWING APPARATUS
Patience, skill, and infinite knowledge through research, alone make it possible to reconstruct in glass enlarged models of the most delicate organisms of life

In all the varied and demanding activities of museum preparation a special technique combined with the ability to improvise or invent is required. (Many of the processes now widely used were devised in the American Museum.) Eloquent of the resourcefulness which a preparator can bring, and often is obliged to bring, to his task, is the fact that Mr. Akeley, in the course of museum work, invented a cement gun which was adopted and widely used by industry, just as he invented a motion-picture camera for field use which is now employed by news reel photographers. It can be seen readily why the Museum preparatory personnel is all "hand picked" and largely "hand grown." There is no school for preparators except Museum experience, and consequently no supply from which full-statured preparators can be obtained.

Men and women of the department of preparation have come to the Museum from many walks of life and many places on both sides of the Atlantic, usually as the result of demonstrating some unusual aptitude which could be turned to the purpose of delighting and instructing the public through the medium of the exhibition hall. It is a matter of record

A PUZZLE IN PALEONTOLOGY
Otto Falkenbach reconstructing a large tortoise from fragments of fossil bone. Infinite patience and knowledge are required for this laborious work

that one man, who afterward became a skilled preparator, first proved his aptitude by the accuracy and judgment with which he wielded a pick in the excavation of fossils. Another, whose occupation was far removed from the scientific, was self-taught in art; the merit of bird studies which he made in spare hours brought him to the Museum, eventually to do outstanding work with the brush. Still others have had unusual skill in glass-working or other of the less common arts.

In the coming to life of museums which long slumbered in a dusty obscurity the twin activities of preparation and exhibition have stimulated and been stimulated by an increasing public interest. And this interest, as well as the recognition of the Museum as a great educational factor which has resulted in city appropriations for buildings to house exhibits, is well justified by the variety, beauty, and content of the great exhibition halls, which soon will number fifty.

The long steps forward which have led to the adoption and development of the habitat group have had so appreciative a response from the public that the further step now being taken in the development of the exhibition hall as a definitely planned and balanced unit should lift the Museum to a still greater place in the community. For the modern hall but carries the habitat group idea to a logical conclusion—as a whole hall of habitat groups, or of related specimens, predesigned in every detail for the purpose, which gives the visitor a balanced view of the fauna, flora, and topography of a whole region, or of the phenomena of a scientific classification.

Such halls, each one an open textbook, may require, from preliminary scale model to dedication, years in the preparation and they may cost hundreds of

thousands of dollars. Yet they are well worth the expenditures of time and money in the sheer pleasure alone which their beauty and interest grant, aside from their obvious purposes of disseminating knowledge of nature with scientific exactness and of preserving for generations to come significant species which are fast disappearing.

A case in point is the South Asiatic Hall, soon to be opened after eleven years of arduous collecting in the field by the late Col. J. C. Faunthorpe and Mr. Arthur S. Vernay, and several years of preparing and mounting groups. The hall, which will hold the finest collection of Indian game groups in existence, and will in every architectural detail create the veritable atmosphere of India, is to be dedicated to public use in the presence of dignitaries from India, England, and this country, as befits one of the finest, if not the finest, museum exhibition hall in the world.

The new Hall of Ocean Life, housed in a separate building within a court, will be, it is believed, the largest of all museum halls given over to a single division of natural history. It will, even though but a single hall, surpass the average small city museum. Another major project, now awaiting increased personnel and money, is the redesigning of the North American Hall of Mammals in order that our own fauna shall be exhibited in a manner fully comparable to those from distant continents.

Other new and prospective halls, awaiting only the funds to carry them forward, might be mentioned if space allowed, but they must be left to tell their own stories to the millions of visitors who will pass through them.

This article cannot close, however, without mention of the Akeley African Hall, conceived and projected by Mr. Akeley as probably the first of these modern exhibition halls. It was his dream and into it to day is going much of his work and planning. Unfortunately the project did not get well under way until after his death. This, it will be recalled, came in his beloved field—"brightest Africa"—to which he had returned, despite precarious health, to gather more of the specimens that make plain to all comers to the Museum Africa's secrets and her beauties.

Such is the zealous spirit of the seeker after truth—the spirit which the preparator must bring to his task.

Pupils arriving at the American Museum for a Public School Children's Lecture

THE MUSEUM IN EDUCATION

Its Unparalleled Present-day Opportunity to Serve the Community and to Participate in the Rapidly Advancing Movement for Visual Instruction

By GEORGE H. SHERWOOD

Director of the American Museum and Curator-in-Chief of the Department of Public Education

DURING the past quarter of a century pedagogical thought has stressed more and more the importance of visual instruction and tactile education, and marked changes in teaching children have been developed. The book learning of fifty years ago has given way to methods which require greater observation on the part of pupil and student, and encourage acquisition of perceptions through hand as well as eye.

Many factors have contributed to this development, important among which are the perfection of the camera, permitting ready recording of experiences and observations, the remarkable development of the motion picture, and the other recent discoveries of science which have made the marvels of yesterday the commonplaces of today.

In this forward movement of visual education, museums of all kinds—museums of art, of history, of industry, and of science—have played and continue to play an increasing part. In the clamor for visual aids and physical objects which can be examined at close range, or actually handled, teachers naturally should turn for assistance to museums, the great reservoirs of treasures from the world over. The museums have responded splendidly, willingly, and themselves have undergone an evolution which has made them a more vital influence in the community. They have passed from a static condition to one of progressive activity; they are now recognized educational agencies whose importance in our school and college curriculums is more widely appreciated every day.

For centuries art museums have catered to the love of the beautiful, inherent in everyone, and have been sources of delight and inspiration. Only comparatively recently, however, have they taken an active part in the educational field, visualizing for child and adult significant facts of history and the achievements of

man. Similarly, historical museums, through their memorabilia and models, make fascinatingly real to the child his otherwise somewhat dry and lifeless history lesson. The infant of the museum family, the industrial museum, has arisen in this industrial age to perform an important mission in illustrating principles of applied science on which our civilization is based.

The growing interest in the out-of-doors, a result of modern ease of travel by bicycle, trolley, automobile, motor bus, and airplane, has given the natural history museum an undreamed of opportunity to serve the community, and participate in this movement for better visual instruction.

The up-to-date museum, therefore, if performing its proper function, must be thoroughly alive. It is not enough for it to be the depository for valuable records, for strange and beautiful specimens, and to accumulate a vast store of information. It must touch the lives of the people through its exhibits and displays. It must be able to make available and intelligible to the people the results of its researches and their application to human welfare.

Through improvements in the technique of preparation, through attractive and readable labels, through the development of the habitat group—which shows the interrelation and interdependence of life—the exhibition halls of the natural history museum have become veritable magnets drawing young and old. The attractiveness of the exhibition hall presentations reflects the arduous efforts of the explorers and field workers who have penetrated to remote corners of the earth to assemble facts, and the careful and painstaking study of the curators who have coördinated these facts and interpreted their significance. It is, however, through direct contact with the school system that museums have become important factors in education.

The American Museum of Natural

THE LANTERN SLIDE ROOM IN THE SCHOOL SERVICE BUILDING

Practically the biggest activity of the American Museum's service to the schools of Greater New York is the lending of lantern slides. A corps of workers is constantly collating the slides into sets to fit the New York City Board of Education syllabus in every school subject. Teachers in the Public Schools of Greater New York may borrow the particular set which best meets their class-room needs

A NATIVE HABITAT BIRD GROUP

The oldest feature of the American Museum School Service is the circulation of nature study collections comprising specimens of mammals, birds, insects, lower invertebrates, minerals, woods, and public health exhibits. These collections are planned to enable the school children to handle and to visualize in natural surroundings the actual animals about which they are studying

History belongs to the modern museum group, and the purpose of this article is to set forth the various phases of the service which it is rendering to schools, colleges, and universities. The Founders of the Museum, led by Morris K. Jesup, J. Pierpont Morgan, Joseph H. Choate, and Theodore Roosevelt, the father of President Roosevelt, foresaw the educational possibilities of the Museum, even in its inception in 1869, and their ideals have been fostered and ably and wisely developed by President Henry Fairfield Osborn throughout his administration.

Early in the Museum's history the desirability of close contact with the school system was realized, and in 1880 Prof. Albert S. Bickmore, that great pioneer in education by the visual method, inaugurated his illustrated lectures for teachers, known as the "Bickmore Lectures." The standard of quality which he established has not been surpassed even today with all the improvements in photography.

The present School Service policy dates from 1904, when nature study was introduced into the curriculum of the city schools and many teachers sought the Museum for visual aids. The Museum school activities have the hearty endorsement of the Board of Education, superintendents, and other school officials of New York City, but the conduct of the work is left entirely to the department of public education of the Museum. The members of the Board of Estimate and Apportionment of the City, too, have expressed their belief in the value of the Museum's service to the schools by constructing our School Service Building with its unequalled facilities for carrying on this work.

The present educational program of the Museum may be grouped under two main headings:

(a) Extra-mural activities—Museum service in the schools and colleges

(b) Extra mural activities—school service at the Museum.

Under the first group are:

1. Circulation of nature study collections.
2. Lending of lantern slides.
3. Distribution of motion picture films.
4. Lectures in schools and special lecture centers.
5. Lending of circulating collections to branch libraries.
6. Coöperation with nature rooms in schools and with organizations working with children.
7. The Trailside Museum and Nature Trails at Bear Mountain.

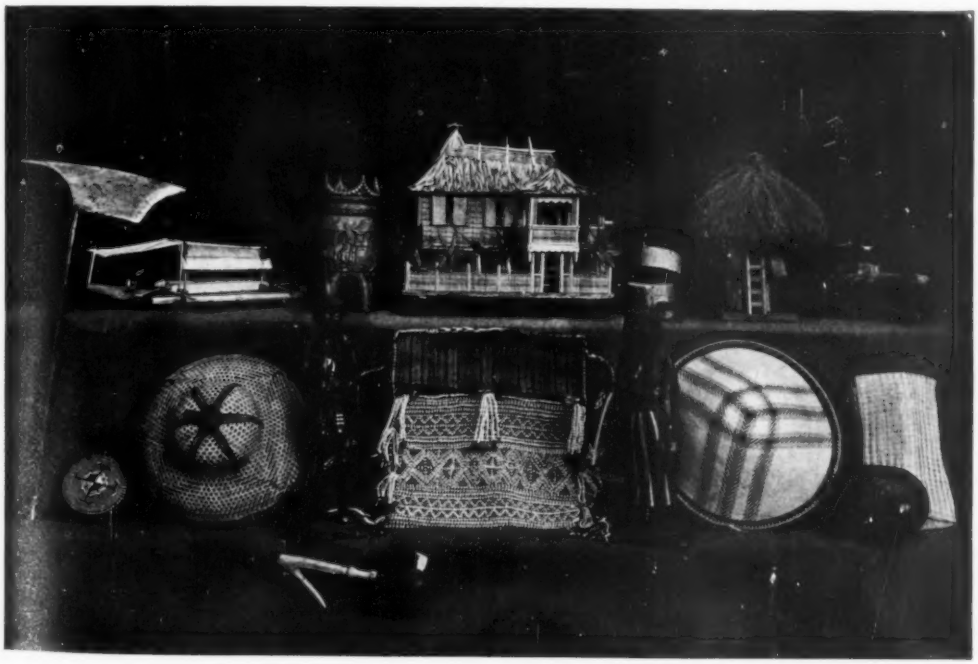
The intra-mural activities include:

1. Lecture courses at the Museum.
2. Instruction for the blind and sight conservation classes.
3. Exhibition hall instruction and guidance for visiting groups.
4. The Junior Astronomy Club.
5. Special courses for teachers.
6. Adult education.
7. Coöperation with the training schools for teachers, high schools, and colleges.

The rapid development of this service in education and the extent of its influence is indicated by the table on this page, which shows an increase of con-

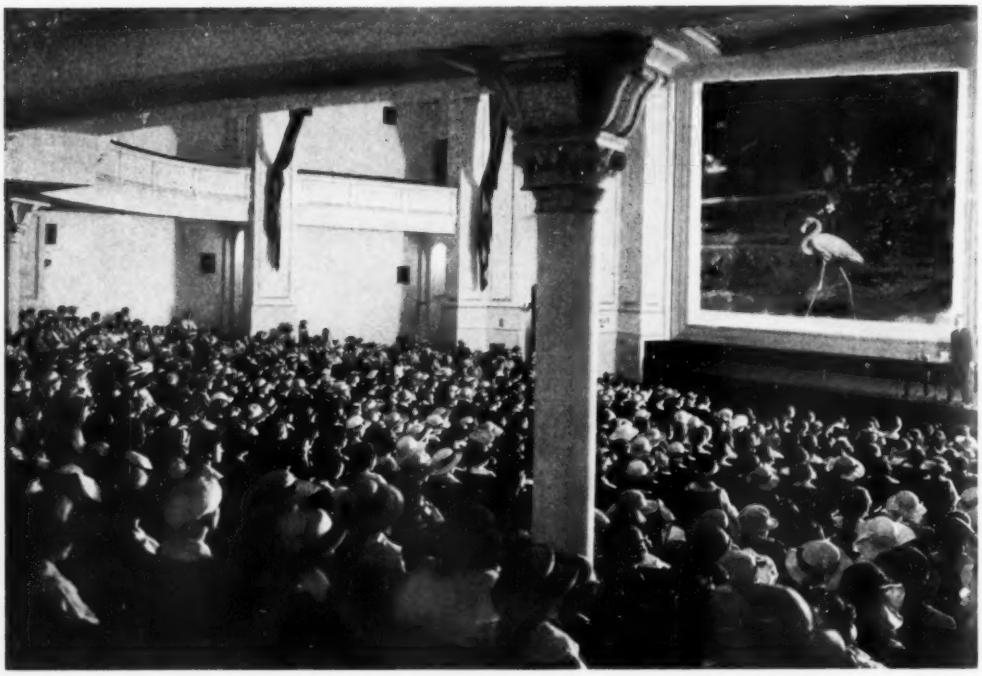
	1914	1919	1924	1929
Visitors, Trailside Museum and Nature Trails, Bear Mountain[1]				186,000
Attendance at Library Loan Exhibits		104,339	33,472	40,283
Attendance at Lectures	65,785	35,221	117,910	226,608
Pupils Viewing Motion Picture Films			115,849	1,725,865
Pupils Using Nature Study Collections	1,273,853	860,992	1,247,914	1,866,399
Pupils Viewing Lantern Slides		records not available	3,147,156	8,550,181
		Grand Total of Contacts	4,662,301	12,595,336

[1]Nature Trails established 1927.



THE PHILIPPINE ISLAND LOAN EXHIBIT

The Museum has prepared for the use of schools and libraries special exhibits illustrating the typical culture of a country or people. The intention of these exhibits is to stimulate the interest of the school child, and through him, his parents, to extend their knowledge of the world and its peoples by wider reading and by visits to the Museum to study the more complete exhibits in its halls



HIGH SCHOOL STUDENTS ATTENDING A BIOLOGICAL LECTURE

Among the cultural courses at the American Museum is a special series of biologic lectures, given by specialists, and arranged specifically for students in high schools and teachers' training schools. The subjects are chosen for their general interest and correlation with the courses of study in the schools

tacts in five-year intervals nearly tenfold in fifteen years, and nearly trebled in the last five alone.

The recent rapid growth of our educational service is one that Museum resources could not have accomplished unaided. Timely recognition and support by the Carnegie Corporation and the Cleveland H. Dodge Foundation made it possible. Further development has been helped materially by generous contributions of funds and advice by Mr. Felix M. Warburg and Mr. George D. Pratt of the Museum's Board of Trustees.

The remarkable success of our present School Service is in great measure due to the fact that the collections, slides, and films are lent to the schools for specified periods and not presented to them. This policy, adopted from the beginning, has resulted in a closer contact between the Museum's educational staff and the schools, has stimulated the interest of the children, and indirectly has led to a more practical use of the material supplied. This intensive School Service is city wide. Museum messengers by motor trucks deliver specimens, slides, films, and other material to schools in Greater New York, without expense to school or teacher.

The oldest feature of the Museum's School Service is the circulation of nature study collections, begun in 1904 in response to many requests from teachers. The collections are contained and displayed in transportation cases about the size of a large suit case. They comprise specimens of mammals, birds, insects, lower invertebrates, minerals, woods, and public health exhibits, selected primarily to place in the hands of the teachers

material actually required in their work. These collections may be obtained by teachers merely for the asking, the Museum representative attending to all other matters, including delivery to the school and the transfer of the collections at the end of the loan period.

To the question "Is this method of visual instruction worth while?" the following statistics are in themselves a sufficient answer: In 1929, 557 public schools regularly received these collections. The total number of loans was 5,327. The specimens were studied by 1,857,729 pupils. It would be impossible to overestimate the indirect value to the thousands of city children who have little opportunity to see the great out-of-doors. The country dweller can hardly realize the restricted environment of many city children. Their knowledge of nature is limited to the dog, the cat, and perhaps the horse. The vegetable market window and the pushcart represent their knowledge of flowers. In a class recently at the Museum a child for the first time saw grass. No wonder, then, that the little nature study exhibits from the Museum stimulate their imagination and broaden their outlook!

Perhaps the most useful feature of the Museum's School Service is the lending of the lantern slides, because of the great variety of the subjects covered, the simplicity of use in the classroom, and their practical application to the work of the individual teacher. The Museum now possesses a library of more than 70,000 slides. The statistics show a phenomenal growth, but, impressive as these figures are, the service can be greatly enhanced if financial provision is made for duplicat-

BLIND CHILDREN STUDYING NATURAL HISTORY

Only through their sense of touch are the blind able to "see" the objects in the world around them. At the American Museum, children of the New York City Schools who are so handicapped have the opportunity, under sympathetic instruction, to handle and learn all about animals, birds, flowers, and minerals

A MEETING OF THE JUNIOR ASTRONOMY CLUB
Mr. Albert Ingalls, of the *Scientific American*, is demonstrating to the youthful members of the Club how to construct a telescope

ing sets of slides, the educational value of which has been established by the use of the original set. At present we are obliged, because of lack of duplicate material, to deny fully 40 per cent. of the requests from teachers for this visual instruction material. So considerable is the demand that some of the lecture sets are reserved eighteen months in advance. A fund of $100,000 can be wisely spent in relieving this situation.

The motion picture film has now an established place as a supplementary aid in classroom instruction. The production of the narrow width film (16 mm.) and the perfection of projection apparatus make it possible to use films more extensively in the schools than has been the case with standard film, where a licensed operator was required under the fire laws.

Through purchase, gift, and deposit, the American Museum has built up an extensive loan library of films, both of standard and narrow width, which are available for the schools and, in part, for other organizations or individuals. Requests from teachers for this type of visual aid make it highly important to enlarge our film library.

For several years the lending of nature study material to the schools has been supplemented by special exhibits lent to public libraries of the city. These are more extensive than the regular circulating collections, their primary purpose being to stimulate the child to read good books and induce him to come with his parents to see the more complete exhibits in the Museum halls.

As one of its contributions to out-door education, the Museum is operating a Trailside Museum and Nature Trail at Bear Mountain, in coöperation with the Palisade Interstate Park Commission. In this primitive forest area, visited each year by many thousands of children and adults, the living specimens in their natural habitats are interestingly labeled, so that the visitor can readily learn about the habits of plants and animals and their relation to their environment. There is a botanical trail, a zoölogical trail, a geological trail,

and a historical trail, this region being of special importance in Revolutionary history. Coöperation with the educational and camping department of the Interstate Park has been carried on, and assistance given to nature councilors and directors throughout the Park with their individual museums and general educational problems. Nature educators from many parts of the country and abroad have studied the trails with a view to establishing similar projects.

Important as are the extra-mural aids, of equal or even greater value is the service which the Museum can give when teachers and pupils come to the Museum. First among these activities are the lecture courses, if numbers are taken as the criterion. Last year more than 226,000 from elementary and high schools and from colleges attended these lectures. Included are the regular courses of lectures given annually in the auditorium of the Museum and designed especially to supplement, *not to replace*, the classroom work of the teacher in geography, history, and natural science. There is also a course for high school students, and a series of lectures or films for the general public on Saturday afternoons, in addition to a number of special lectures arranged upon request. The enthusiasm of principals and teachers is evidence of the value of this branch of the Museum service.

The instruction given through the lectures in the auditorium, which seats some 1,500, is mass instruction, in which many schools are represented at each lecture. In order to give more intensive instruction than is possible in an auditorium lecture, we have recently developed a series of exhibition hall talks. Under this plan a single class of pupils is taken into

A SCHOOL GROUP GATHERING INFORMATION ABOUT MINERALS

By making arrangements in advance, teachers who desire to bring groups to the American Museum for study may have the services of an instructor who will accompany them through an exhibition hall, thus enhancing the value of the visit

THE TRAILSIDE MUSEUM AT BEAR MOUNTAIN

Visiting groups from near-by camps always find a warm welcome awaiting them at the Trailside Museum. Here they get first-hand knowledge of the wild animals and plants of the vicinity, a knowledge that is of practical value to them during their camping sojourn

one of the classrooms of the School Service Building personally to examine and handle material under the guidance of a Museum instructor. After half an hour in the classroom, the group is taken into the exhibition halls to examine the larger collections pertaining to the particular subject of the talk. This development is meeting hearty commendation.

A specialized branch of the Museum's educational work is the instruction for the blind which has been developed through a special endowment, the Jonathan Thorne Memorial Fund. The blind children in New York City are taught in the same public schools as normal children. They are grouped in sight conservation classes in charge of trained teachers under the guidance of a special supervisor. The Museum makes special provision for these children. In consultation with the Supervisor for the Blind, informal talks which can be illustrated with actual specimens or with apparatus are given by the Museum staff.

Another important feature of the Museum's service is the general guidance through exhibition halls. The well-labeled exhibition hall, with its habitat groups, its carefully selected specimens, and its well thought-out arrangement, stands as the great silent teacher, a true exponent of visual education. What a vast store of information is contained in these halls, and what an aid they are to teachers in giving to their pupils accurate knowledge of nature! By making arrangements in advance, teachers who desire to bring groups for study and examination of the principal exhibits may have the services of an instructor who will accompany the group through the exhibition halls, thus enhancing the value of the visit.

A new development of our educational program of special interest to children is the Junior Astronomy Club for boys and girls in organized coöperation with our department of astronomy. Meetings are held weekly and programs are

given alternately by club members and by guest lecturers. The club is conducted by its own members, which stimulates the children's initiative and will do much to develop leadership. The children have shown a keen interest in this subject.

Last year the Museum arranged two courses of lectures and laboratory work for teachers,—a course in geography primarily for teachers in the elementary schools, and a course on natural history topics for teachers in high schools, colleges, and universities. These lectures were given by members of the scientific staff of the Museum, and their purpose was twofold: first, to give to teachers in background lectures some of the intimate information resulting from the explorations and researches carried on by the Museum, and their relation to similar researches elsewhere; and, second, to give to the teachers something of the inspiration of personal contact with explorers and other scientific workers who have achieved success. The experience of the past year indicates clearly that this service is heartily welcomed and plans for its further development have been made.

Mere mention of the names of the organizations, institutions, and individuals who have sought Museum assistance would be altogether too long to include in this article. For years, however, the department of education has coöperated with the Training Schools for Teachers of the city, supplying material to the pupil teachers; coöperation has been extended to the colleges and universities of the vicinity, and many groups from such institutions have utilized for study and

A TRAILSIDE EXHIBIT

The children who live near the Trailside Museum at Bear Mountain lose no opportunity to visit the nature trail exhibits of live creatures, and often bring to the Museum helpful additions to its collections

IN THE "NATURE ROOM"

The American Museum has set apart this room in the School Service Building especially for the activities of the School Nature League. So popular has the Nature Room become that there is scarcely ever an hour in the day when there are not present several groups of interested students of Nature

research the valuable collections to be found in our exhibition halls and study rooms.

While the foregoing review of the Museum's educational activities makes an impressive record, in reality only the surface of the possibilities for service has been scratched. Up to the present time attention has been given principally to service for the elementary schools, and only recently have plans been developed for a more intensive service for high schools, colleges, and universities, and for teachers themselves. The Museum with its incomparable collections in many branches of zoölogy, geology, and palæontology, with its highly trained men of science, with its special researches, with its publications, is a fertile source of information for advanced students in colleges and universities. The next phase in the development of the Museum's educational service is provision for closer coöperation with such institutions of learning.

Where can the student of palæontology find such illuminating material as exists in our hall of palæontology? Where can the student of ornithology find a more comprehensive presentation of birds in relation to their environment than in our habitat bird groups? Where can the student of anthropology obtain better material for his studies than in our anthropological halls? The hall of reptiles, Darwin hall, and the hall of insects have proved of inestimable value to teachers and students of fundamental biological principles. In short, all of our exhibition halls, supplemented by the

vast collections in the study rooms, are great indoor laboratories for science students. With the idea of bringing about closer coöperation between the Museum and the colleges and universities of the city and vicinity, special provision is now being made for the reception of such groups and a more intensive use of the exceptional facilities which the Museum possesses.

Another almost untouched opportunity is in the field of adult education. Here the Museum can render a valuable service to adults by giving instruction, illustrated with Museum specimens, to industrial groups, to those of foreign parentage who are eager to learn of American institutions, and to those who are desirous of having a more intimate knowledge of the latest developments in biological research and who want to know more of the Museum's methods of exploration and discovery.

Further growth of the existing branches of the Museum's School Service and these new activities briefly outlined are held in abeyance until additional financial support can be secured. Here is an opportunity for generous-minded friends to make a direct contribution to human welfare because of the far-reaching influence of the Museum's work.

A TAXIDERMY CLASS AT THE AMERICAN MUSEUM

Here Boy Scouts are being taught how to prepare specimens for use in their own museums, in camps, and at Troop meeting places. The profession of taxidermy has drawn into its ranks more than one Boy Scout who had his initial instruction in that art at these classes

A view in the composing room of the American Museum Press

THE AMERICAN MUSEUM PRESS

An Open Door to a Quickened Knowledge and Appreciation of Natural Science for a World-wide Audience

By HAWTHORNE DANIEL
Curator of Printing and Publishing, American Museum

IN a very real sense the whole world comes to the American Museum of Natural History, whose roster of visitors, if so huge a book could be conveniently kept, would be seen to include men and women from all parts of this continent and all nations on the globe. Yet the million of visitors who each year traverse its halls mark but the beginning of the Museum's world-wide contribution to the knowledge of Nature and to advanced scientific thought. Had the Museum relied only upon its exhibition halls and lectures for the spread of its gleaned information, it would still be great and influential, but it would not be the household word it has become in virtually every land.

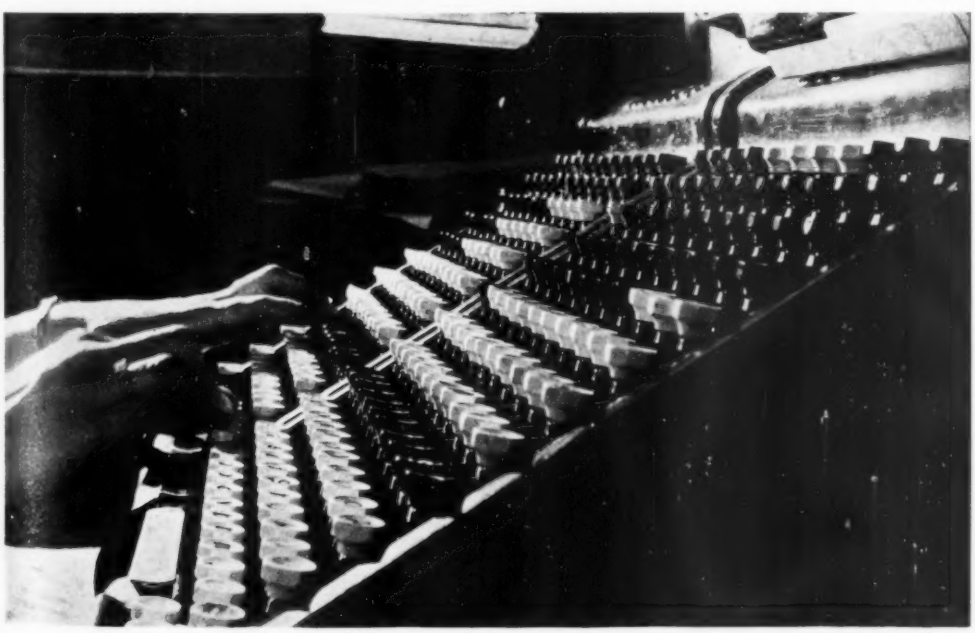
Time was when the scientist worked and lived as a recluse. He was a man apart, who neither sought nor expected to have his labors understood and who felt under little obligation to distribute his knowledge. But science has become indispensable to everyday life and habitual to everyday thought. What the scientist has to say goes broadcast by printed word to all seekers, and in this age they are many. Meanwhile, the scientist has come to see the opportunity which the printing press gives him to inform and to educate. This he does through scientific articles, through scientific and "popular" books, through handbooks, textbooks, and guidebooks, and through articles in magazines and newspapers. Thus a scientific group, such as distinguishes the American Museum, has an audience, and wields an influence upon thought, for which there is no territorial limitation.

The detailed list of publications by the Museum scientific staff and affiliated scientists which the American Museum Press issues is formidable, and to it can be added an even longer list of books and articles distributed through outside

publishers. The one is addressed primarily to a scientific audience and reaches the general public only by proxy; the other goes to the larger and growing audience that seeks vicarious travel, knowledge of what Nature so lavishly provides at home and in odd corners of the world, and the stimulation of threading—with the scientist turned popular guide—the miracled paths of the ages and the newly surveyed byways of today.

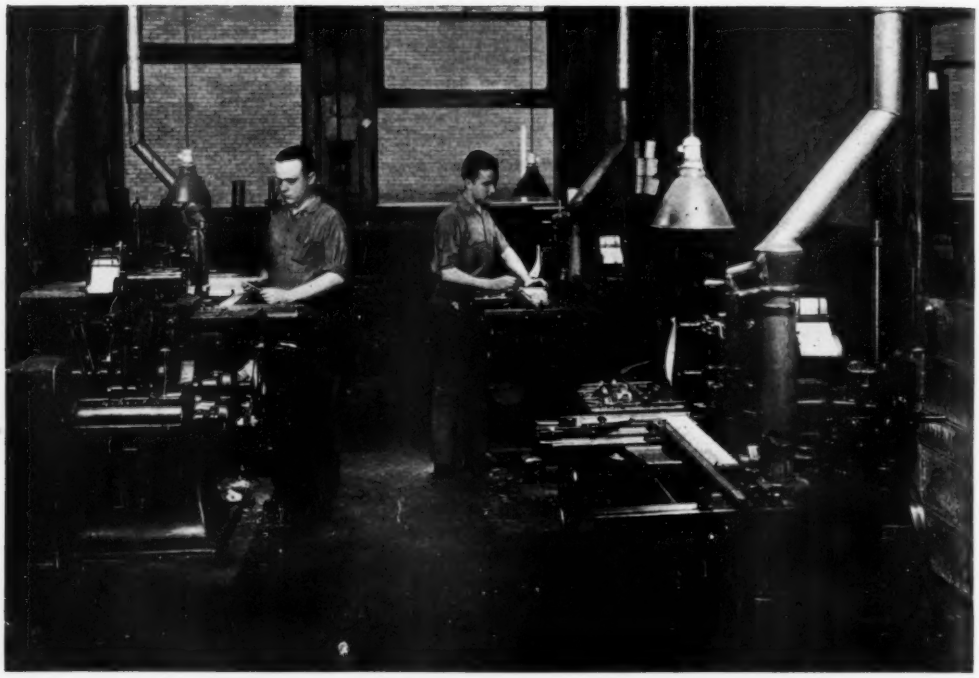
For Museum authors the pace in output and in impress upon the public mind has been set by the president, Henry Fairfield Osborn, who, entirely aside from technical works, generally issued by the Museum itself, has opened to many thousands of laymen readers in many languages the door to understanding of the larger problems and broader dramas of Nature from the beginning. "It is not enough for scientists to know," says Doctor Osborn, "it is important that *people* should know." Accordingly, palæontology, archæology, biology, and evolution become to the world at large more than words. In *Men of the Old Stone Age* Doctor Osborn is credited with having produced the standard work on archæology, with a virtual sequel in *Man Rises to Parnassus.* In *The Origin and Evolution of Life*—translated into French, Spanish, German, and Japanese—is seen the whole scope of evolutionary rise; in *The Evolution of Mammalian Molar Teeth* the rounding out of one phase of research into the broad picture of the past. Other works in a varied list too long to appear in detail include *The Age of Mammals, From the Greeks to Darwin*—translated widely, *Impressions of Great Naturalists, Evolution and Religion in Education,* and *Creative Education in School, College, University and Museum.*

In length of list Dr. Frank M. Chapman, dean of the Museum's scientific staff, follows Doctor Osborn, with the delightful and authoritative bird



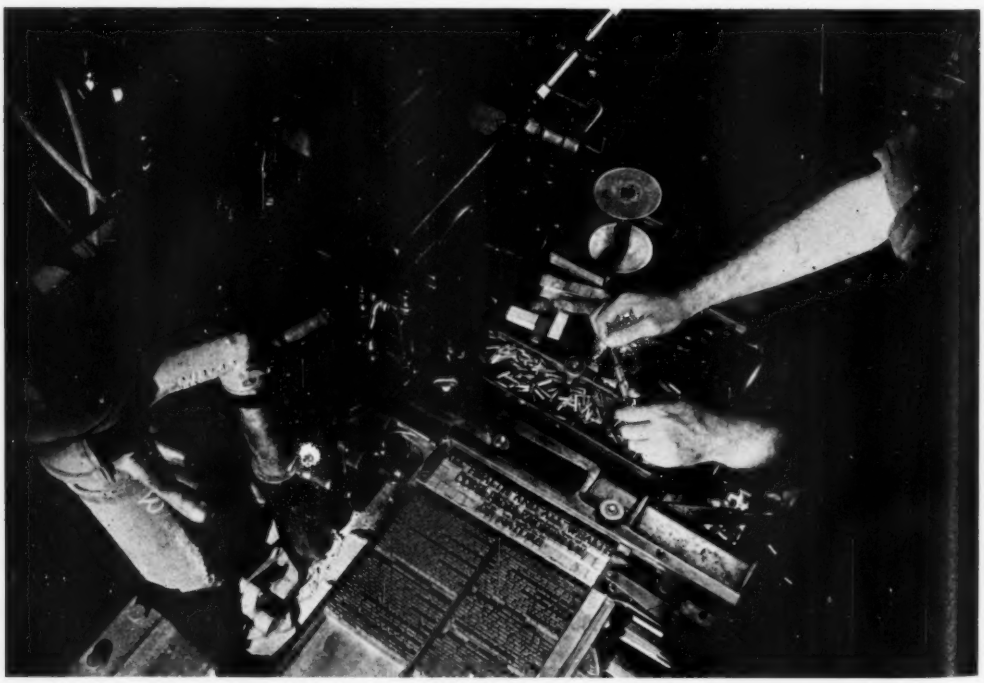
THE MONOTYPE KEYBOARD

By pressing the keys, the operator cuts stencils into a paper ribbon, which later is run through and controls the type casting machines



MONOTYPE TYPE CASTERS

The stenciled ribbon can be seen in place in the type casting machines. These machines cast individual types, which set automatically, line for line, in a galley (printer's tray)

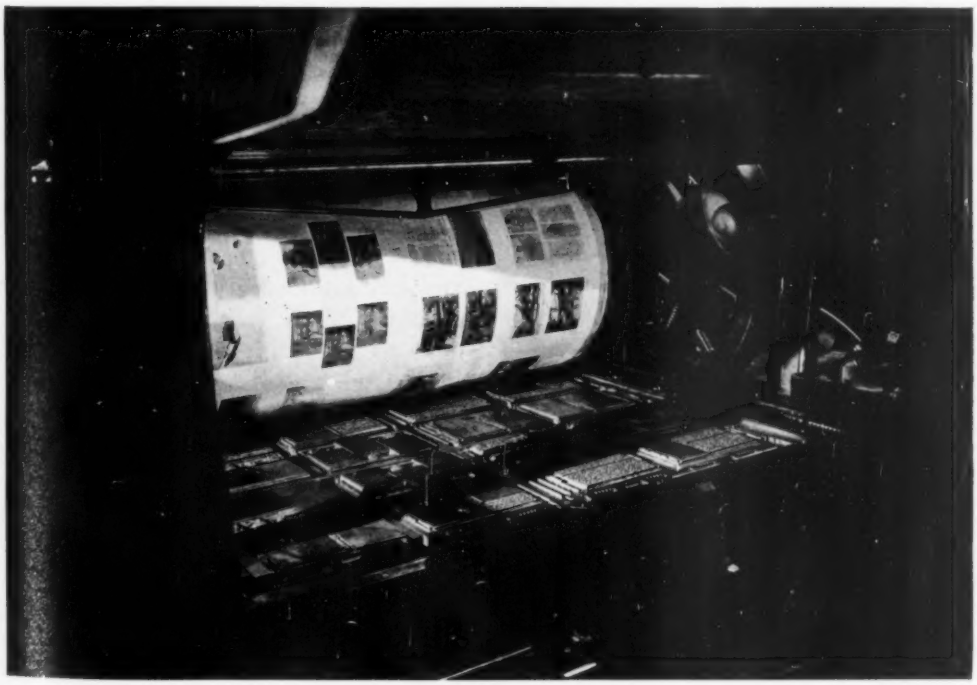


AN OPERATOR MEASURING TYPE

It is absolutely necessary that the type size for each fount of type be accurate down to 1/10,000 part of an inch. The operator of the type-casting machine measures the type with a micrometer

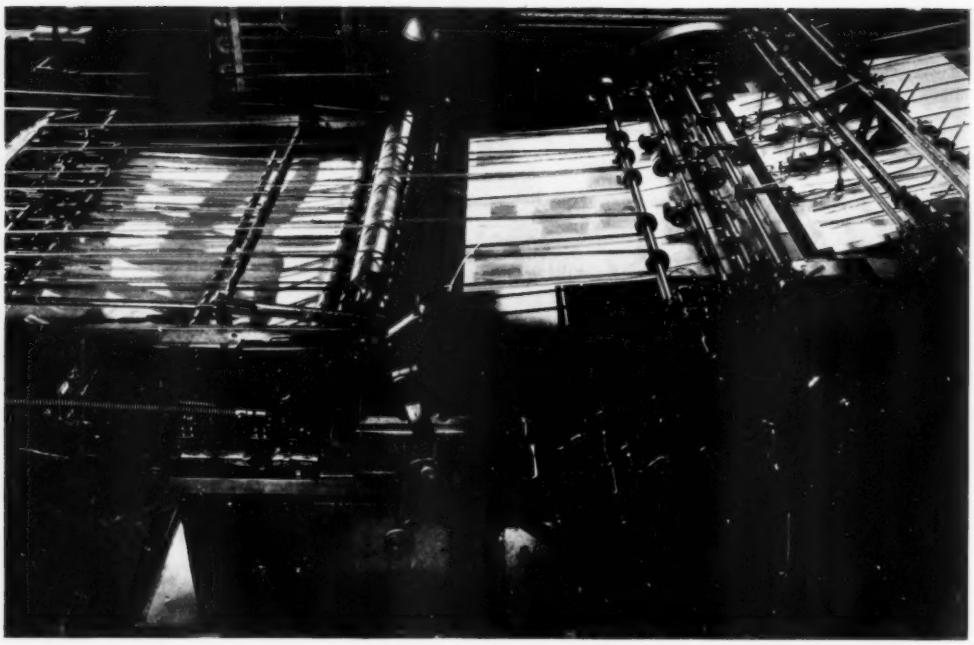
A CORNER OF THE PRESS ROOM

Showing the automatic cylinder press on which NATURAL HISTORY and most of the Guide Leaflets are printed



THE CYLINDER AND THE TYPE BED

It is in this section of the press that the actual contact is made between paper and type. On the cylinder is a freshly printed sheet of the July-August issue of NATURAL HISTORY



ON THE WAY TO THE STACKING PILE

After the NATURAL HISTORY sheets are printed, they are delivered along the tapes to the platform underneath the end of the machine, where they are automatically straightened and stacked

literature that has done so much to muster armies of bird-lovers, while many others—through their writings—have vastly quickened knowledge and appreciation of Nature. Akeley, Andrews, Anthony, Beebe, Breder, Brown, Burden, Chapin, Clark, Dean, Fisher, Gregory, Gudger, Johnson, Kunz, Lutz, Mead, Miner, Morden, Murphy, Nelson, Noble, Reeds, Wissler—these are a few of the familiar names.

Though less direct in their dissemination of general knowledge, the technical scientific publications of the Museum and its staff, nearly all issued by the Museum Press, have an influence that is far-flung. Distributed regularly to 952 learned societies in nearly all lands, they become an integral part of the working knowledge of world-science. They are known and used to such an extent that in a number of fields scarcely any scientific project is undertaken without reference to them.

These publications, usually the work of curators of the Museum, customarily have been issued in three forms: The *Novitates*, tersely outlining new discoveries or descriptions, which generally establish a priority and form the basis of more elaborate treatment later; the *Bulletins*, papers on zoölogical, geological, and palæontological subjects given detailed handling, and the *Memoirs*, in quarto volume size, in which important subjects are given extensive handling and copious illustration with an impressive massing of established evidence. Classified separately are the papers on anthropological subjects, regularly issued, and important special volumes, including a monograph, *A Review of the Primates*, by D. G. Elliott; and the Bashford Dean *Bibliography of Fishes*, in three volumes, with a fourth awaiting publication.

Among important works being published are an outstanding Memoir by President Osborn on *Evolution of the*

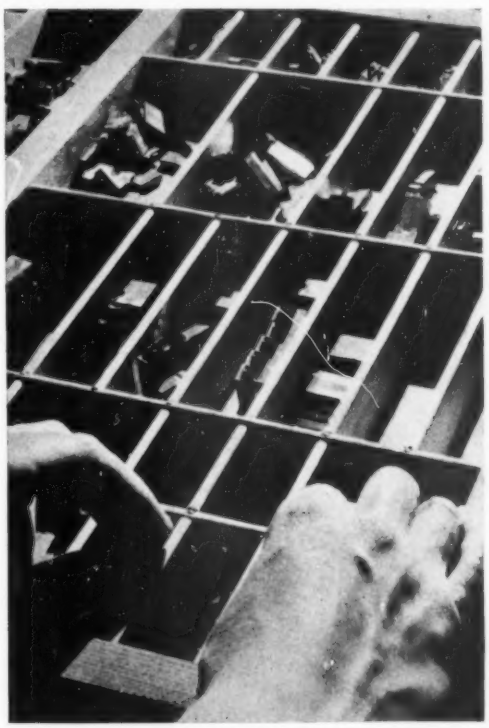
Proboscidea, now largely in type after twenty-three years of preparation but awaiting before going to press the evaluation of material discovered in recent months; and a *Bashford Dean Memorial Volume*, which will give in about ten parts, to be issued over a period of years, an appreciation of the life and American Museum work of this distinguished former curator of ichthyology, with scientific studies of unpublished drawings and material left by him.

It is a commentary upon both the exploration and research of the Museum that, since 1921, discoveries or new scientific findings have been announced in 427 *Novitates*. Since 1881, which marked their start, the *Bulletins*, soon to number 61 volumes of 600 to 700 pages each, have contained about 1000 articles. The *Anthropological Papers*, now approaching their 32d volume since they were instituted as such, and the 17 volumes of *Memoirs*, bring to about 1600 the total of scientific articles issued through the Museum's regular channels.

This total, impressive though it be to one who examines the titles, does not represent the Museum's potential contribution to science publication. Only through an increase in the editorial staff, which is charged with the responsible task of editing and reading proof, and in the mechanical forces, could the quickly available material be sent to press, while only through an increase in scientific assistants could the curators, shorthanded and handicapped by routine duties, be released to work up great quantities of other material that should receive publication.

So exacting are the requirements of science—which must work continuously, and with no margin of error, from established facts toward the previously unknown or unproved—that preparation of some of these works represents a lifetime of gleaning in a single field. The total labor upon many others can be measured only in months and years. *The Titanotheres of Ancient Wyoming, Dakota, and Nebraska*, (prepared for Government printing by President Osborn as vertebrate palæontologist of the United States Geological Survey) with its two volumes, 953 pages, 236 plates, and 797 figures, occupied nearly thirty years from the start of the work to its issuance in bound form last year.

With meticulousness the first requisite in the literary preparation of scientific publications, "following copy" is no less imperative, though it lead through a maze of scientific names, foreign names, special scripts and characters, formulæ, equations and signs, which try the sureness and inventiveness of the printer. For this



A SECTION OF A TYPE CASE
These cases are filled with type from the monotype caster. This type is used for making corrections by hand

THE VERTICAL AUTOMATIC JOB PRESS
Here is a NATURAL HISTORY cover being fed into the vertical press

reason, as well as to fill the general printing requirements of so large an institution, the Museum has its own printing plant and bindery. Started in 1903 with one man and a hand press, the printing plant now has a foreman (the original printer) and fifteen men, and the bindery a foreman and six men. It is significant that of the printers all but four received their entire training in the American Museum Press.

From this plant, after preparation by members of the Museum staff, also issue the popular publications of the Museum—including the *Handbooks*, *Guide Leaflets* and NATURAL HISTORY. The first, often used as textbooks, deal with subjects illustrated by collections in the Museum; the second, with exhibits, series of exhibits, or whole halls of the Museum. Numbering at present some 75 catalogued cloth and paper-bound booklets and leaflets, these, with the large *General Guide to the Exhibition Hall*, have an important part in the educative function of the Museum as a whole, just as a score of publications of its department of education further the more formal teaching activities.

For acquainting the Museum's friends with its scientific and financial condition as an institution, reliance is placed mainly upon a very complete and detailed *Annual Report*, issued by the Museum Press. All holders of Museum memberships—distributed throughout the Union and sixty-six foreign countries—receive also one of the most valuable and effective of all Museum publications—NATURAL HISTORY.

This Journal of the American Museum of Natural History is, indeed, the largest individual task of the publishing department. Established in 1900, and hence in its thirtieth volume, NATURAL HISTORY six times a year takes to readers in all parts of the world articles by ex-

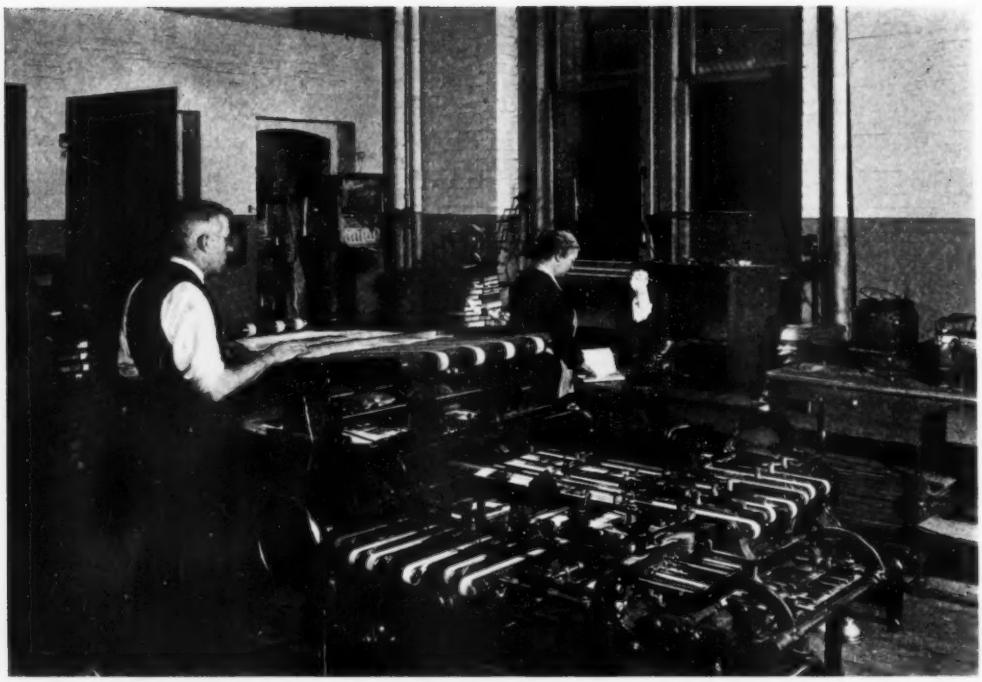
plorers, travelers, and men of science—many of them of the first eminence—which in their treatment, readable but sound, and in their copious illustration, are "popular" in the best sense of the term. They cover scientific research, exploration, and discovery, development of museum exhibition, museum influence upon education, and other pertinent subjects.

Primarily they are based on American Museum activities but often include other significant work and observation. In the files of NATURAL HISTORY are to be found lucid and thoughtful treatment of most great explorations and research developments of the past thirty years, as well as widely quoted and reprinted material from the pens of Museum authors, and some of the best products of the brushes and pencils of Museum artists.

For the printing of the great variety of scientific and popular publications of the Museum, as well as its administrative matter and "job work" the Museum Press is finely equipped and conveniently laid out. It occupies four large rooms in the basement, with a spacious and equally well-equipped bindery adjacent. The Museum Press, familiar with the requirements of the scientific writer, sets all its own type, mainly with its two monotype keyboard machines and three type casters,—equipment which makes for speed of production and eliminates the expensive burden of distributing large blocks of type after the press run is over. Every sound device of the printer to produce a good finished result is used. The casting is so accurate that when a letter mold becomes worn a thousandth of an inch it is replaced. Just as accurate is the "type high" machine which shaves the type to the exact 918–1000 inches required. A saw trimmer enables the plant to do its

AFTER PRINTING

The finished cover being delivered from the vertical automatic job press



A GLIMPSE INTO THE BINDERY

With this folding machine it is possible to fold a sixteen-page section of NATURAL HISTORY at a speed of 3000 an hour

FEEDING BY AIR PRESSURE

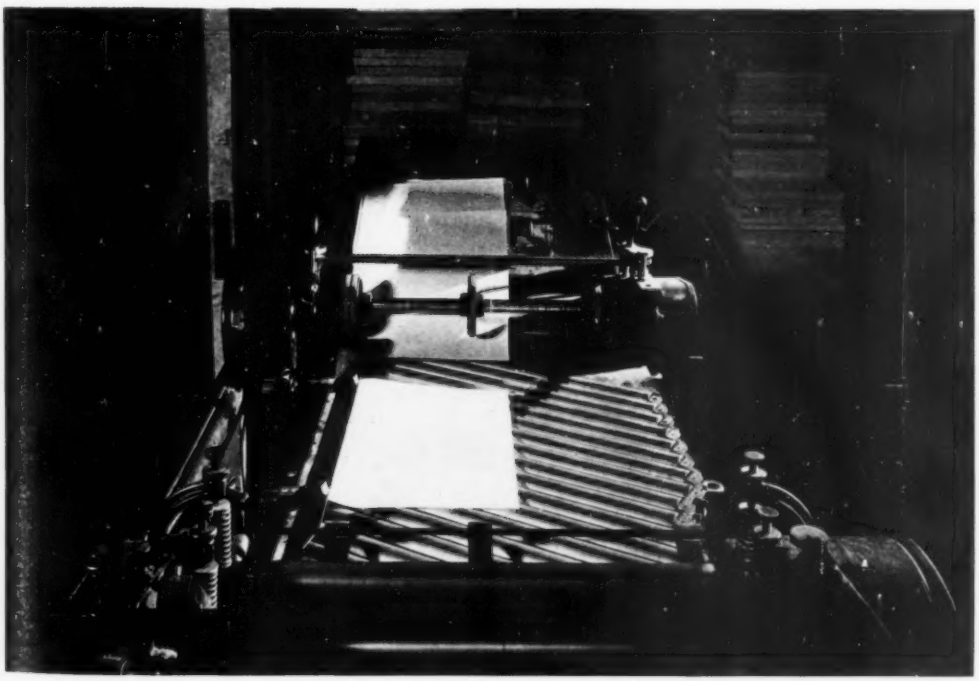
A view of the continuous air feeder of the folding machine shown at the top of this page. Each sheet is lifted by air pressure to a vacuum, which draws the sheet into the folder

own trimming and routing of cuts and blocks.

In the spacious press room are three job presses of usual type and an automatic vertical press of great precision and speed which best turns out certain classes of Museum work. The larger publications, including NATURAL HISTORY, are run off on two ten-ton cylinder presses, of 33×44 inch printing surface. One of these has a labor-saving automatic feed, which makes possible putting two tons of paper through the press, without attention, before renewal is necessary. In the bindery, with its high-speed machinery for folding, stitching, counting, and other processes, there is the same attention to the achievement of high-grade results with a minimum of labor.

Records of the department of printing and publishing show a steady increase in demands upon this plant—a half year's tally, up to June 30, for instance, showing an increase of 12.5 per cent. over the corresponding six months of 1929.

Last year the Museum Press set up and printed 3925 pages of scientific material, 352 pages of guide leaflets, 328 pages of department of education material, 100 pages of department of administration material, 672 pages of NATURAL HISTORY, and 600 pages of reprints. The regular issues of NATURAL HISTORY ran to 100,000 with 6720 reprints additional. The usefulness of the press to the Museum, aside from publication of scientific, popular, and administrative books, booklets, and leaflets, is best shown by the fact that in the same year it had an output of a million pieces of printed matter for use in running the multitudinous activities of the great American Museum.



FEEDING BY FRICTION

In this machine each sheet is drawn by friction between rubber wheels and is then guided over rapidly revolving diagonal rollers into position for folding

THE AMERICAN MUSEUM LIBRARY

A Treasure House of Scientific and Natural History Lore which Plays an Important Part in the Activities of the Whole Museum and Serves a Large Reading Public

By IDA RICHARDSON HOOD

Acting Curator of Books and Publications, American Museum

WHILE the excellent library service of the American Museum is not classified among the main functions outlined in the foregoing articles, it is an indispensable facility upon which all departments depend heavily. So great is the recourse to it in the furtherance of virtually every project that it becomes a central point in the scientific activity of the whole institution.

The chief function of the Library is to provide for the scientists on the Museum staff the literature necessary for their research work and to keep them informed of scientific progress in general. It also supplies to other scientists opportunity to consult such publications as are not available in their own institutions. The excellence and completeness of the Museum collection of books often make it urgent for even those living at long distances to bring their problems here. Many of the well known scientists of the vicinity are frequently seen in our Library. Effort is always made to find the desired references, even though the clues are often obscure. Again, the Library serves a host of transient readers, artists, illustrators, students, newspaper and other writers, representatives of commercial firms and many others whose search for unusual information, a picture, an elusive reference not to be found elsewhere, or general information on some natural history subject, brings them to our reading room. The Library is also the distributing agent for the Museum's publications, both scientific and popular, a great number of which are sent out on exchange, in return for which valuable material is received from all corners of the globe.

The Library is unusually fortunate in possessing an excellent foundation of early files of scientific periodicals and rare standard natural history classics, upon which a superstructure of equal value is gradually being built. Each year other rare items and new files of periodicals are acquired, as funds or gifts make possible, until the Library has become one of the finest of its kind in the country, in scope second to but one or two, which had the advantage of a much earlier foundation and accordingly have a larger collection of older series. Aside from its actual value as a source of information to a wide circle of readers, the Library, therefore, is also an important factor in reflecting the high standards and wide vision of the institution of which it is a part.

Since the primary object of the Library is to serve the staff and so aid in the proper functioning of each department, it must necessarily cover a wide range of subjects and maintain a variety of material. Such series as the *Zoological Record*, *British Museum Catalogue*, *Union List of Periodicals*, and a score of others facilitate the finding of references and are in constant use. Those monographs, textbooks, or periodicals which the respective departments need for reference may be borrowed by members of the staff and kept for an indefinite period in the offices and laboratories. The books, in short,

are where they are most needed but are always available upon short notice.

The Library is at the disposal of the public for reference purposes, with trained librarians in attendance ready to assist them in their search for information, for unusual pictures, or for a few hours of pleasurable reading on a natural history subject.

Exploration is one of the important activities in which the Library is of assistance. Preparatory work of the most intensive kind is necessary before an individual can enter a region whose climatic, geologic, and hygienic conditions are unfamiliar to him, and even the well informed scientist must familiarize himself thoroughly with all that has been noted of the known fauna and flora. Meeting this need forms the Library's share in expedition preparation. For instance, Admiral Byrd filled a room at the American Museum with volumes from the Library, to be used by his staff prior to departing for Antarctica. William Beebe also before his departure for parts unknown makes constant use of the Library. The members of the Crockerland Expedition, of the Whitney South Sea Expedition, of the Central Asiatic Expeditions, and many others have frequented the Library, not only prior to their departure but for comparative work upon their return.

As has already been stated, the Library's share in research is the far from small service of providing the workers with desired references, often obscure or incomplete. This demands the services of librarians especially trained in scientific reference work. The Library has even checked and corrected bibliographies sent by authors through the mail, when they were unable to revisit the Library to do

THE READING ROOM OF THE AMERICAN MUSEUM LIBRARY
In this pleasant and well-lighted reading room visitors are welcome to read and study the reference books arranged in the racks along the walls. Other books on specific subjects and periodicals may be obtained from the librarians in attendance

the work personally. Such services have called forth unstinted praise from those familiar with the country's larger libraries.

The Library is sometimes resorted to for a check upon moot points regarding poses and color of animals, and settings and foliage for groups. Thus, through its many beautifully illustrated volumes, the Library makes a definite contribution to the preparation of exhibits.

An attractive and well lighted reading room, whose walls are lined with shelves containing the more general reference works, invites the visitor to do his research here, or to follow up, with the assistance of a librarian, study which may have begun at one of the various reading tables in the exhibition halls. These tables, with specially constructed cases containing books pertinent to the respective exhibits, are a recent suggestion of President Osborn and are making a direct contact between the material of the exhibition hall and the literature on the subject. They have proved of strong popular appeal and of value in stimulating the public to read with a purpose.

In a certain sense, all Library work is educational. Yet, specifically, the Library coöperates with the schools and colleges of New York and vicinity by helping students with their research references. Although those from the institutions of higher learning predominate, the younger student is often sent here, or comes voluntarily, to get material for a nature note book, or to follow up some youthful interest in birds, butterflies, snakes, rocks, minerals, or Indians. The School Service Library handles the major portion of these young people but, even during vacation, they find their way to the main Library and often spend hours absorbed in reading. The Osborn Library of Vertebrate Palæontology is constantly used by students of that subject.

With the rapid advance of the Museum, service to the ever-widening interests of an increasing staff and a larger public is the main object; therefore the most imperative need of the Library is, while maintaining its standard, to keep pace with this rapid and diversified Museum growth. Nevertheless, in the last few years, the Library has been forced to face a serious insufficiency of funds. The purchase of books has been limited to the utmost, and, as a result, each department which uses the Library feels itself handicapped. Cost of scientific periodicals and books has increased in the past eleven years from 100 to 300 per cent., while the department's budget has been static. With Europe and America recovered from the paralysis of war, the scientific world is being showered with literature, brimming with important information, little of which can be safely overlooked, and the Library finds that the call for books has increased more than 50 per cent.

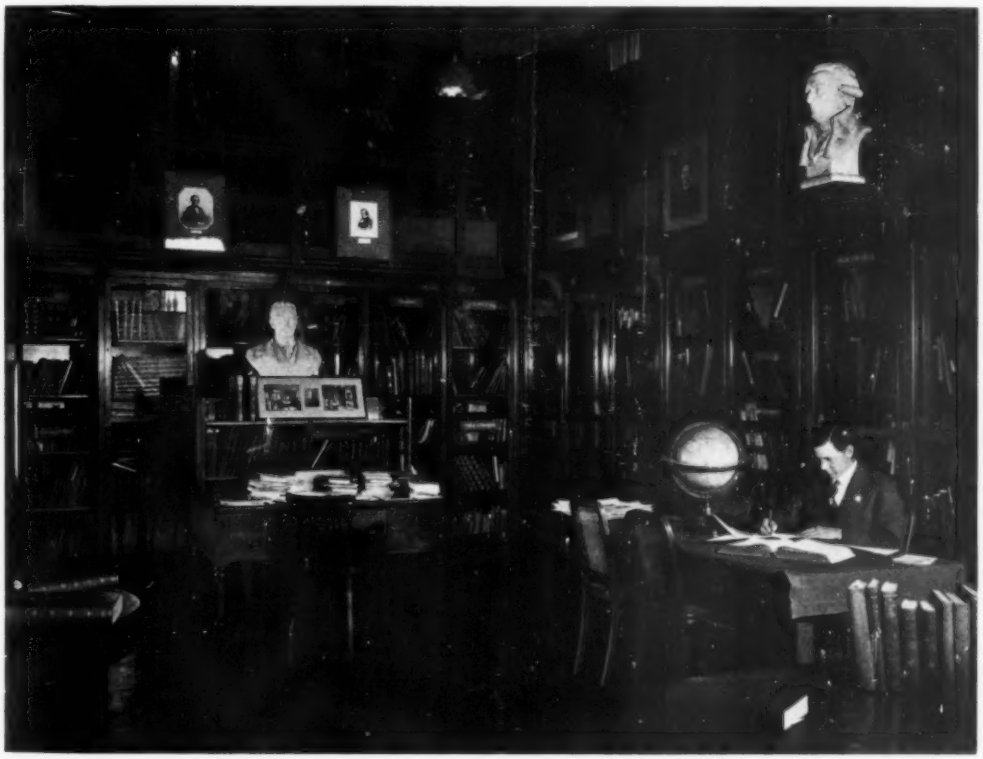
Equally serious is the situation regarding the "second-hand" books of science now out of print. Competition and scarcity each year are driving up the prices, and it is both a scientific and an economic obligation to seize present opportunities to fill gaps in our shelves. Lack of available purchase funds recently lost to us valuable items which had not previously been quoted on the market for twenty-five years and may not be located again in a generation.

Often strange requests—generally arising from a need for information to be used practically—are received in the Library. Here again the Library renders a little known service of the Museum to the public at large. Artists, commissioned to make cover designs or illustrate literary works, come to us seeking such material as "jungles in Java," "a landscape in Palestine with definite kinds of cattle grazing," "a peacock in color and in a certain position," "a picture of flying swans," "an angora goat in color," and "the foal of a horse only a few days old. . ."

A magazine cover design resulted from an inquiry concerning an "Aurora Polaris at the South Pole."

Museum Library coöperation facilitated the issue of two expensive catalogs, respectively by a motor car manufacturer and by a silk manufacturer, advertising unique new colors based upon exotic birds, fish, minerals, gems, and other natural objects. The Library once told a motion picture producer upon request what kind of cart should be used by Rudolph Valentino in a certain South American locale. Industrial research laboratories, writers of railroad and other travel literature, compilers of encyclopædias (including the latest *Encyclopædia Britannica*), newspapers, scientific editors are but a few of those who use our facilities with an evident gratitude that they exist.

It has been a great satisfaction to recognize among visitors seeking inspiration in our Library famous artists, sculptors, Indian painters and writers, for if we are able to supply correct and authentic data for a motion picture, a painting, an illustration, or a piece of sculpture, we are indirectly educating the public, by making available exact information to many more thousands than can come to the Library in person.



THE OSBORN LIBRARY OF VERTEBRATE PALÆONTOLOGY

Established by its patron, President Henry Fairfield Osborn. In this beautiful room is housed one of the most unique and important collections of books on its specific subject to be found in the United States

© B. A. E.

Hauling supplies by dog team from ship to camp

OVER THE SOUTH POLE BY AIR

Some Phases of the Polar Region Survey of 1928–30 Achieved with All the Practicable Appurtenances of Modern Science

By REAR ADMIRAL RICHARD E. BYRD
As Told to Albert D. Barker

WHENEVER I discuss with strangers the discovery of new territory by the Byrd Antarctic Expedition, I brace myself for the inevitable inquiry, "What use is it, now that you have found it?" Always I reply that whatever man finds, he finds a use for. This application of new knowledge to human needs or wants may require a short time, or it may require a century or more—but it inevitably comes.

Just as a museum searches, collects, and identifies as a task of pure science, so does the explorer answer the challenge to push into the great unknown areas of an ice-locked continent to see what man has not seen before, and thus add to the sum of human knowledge. The use he leaves in all confidence to time.

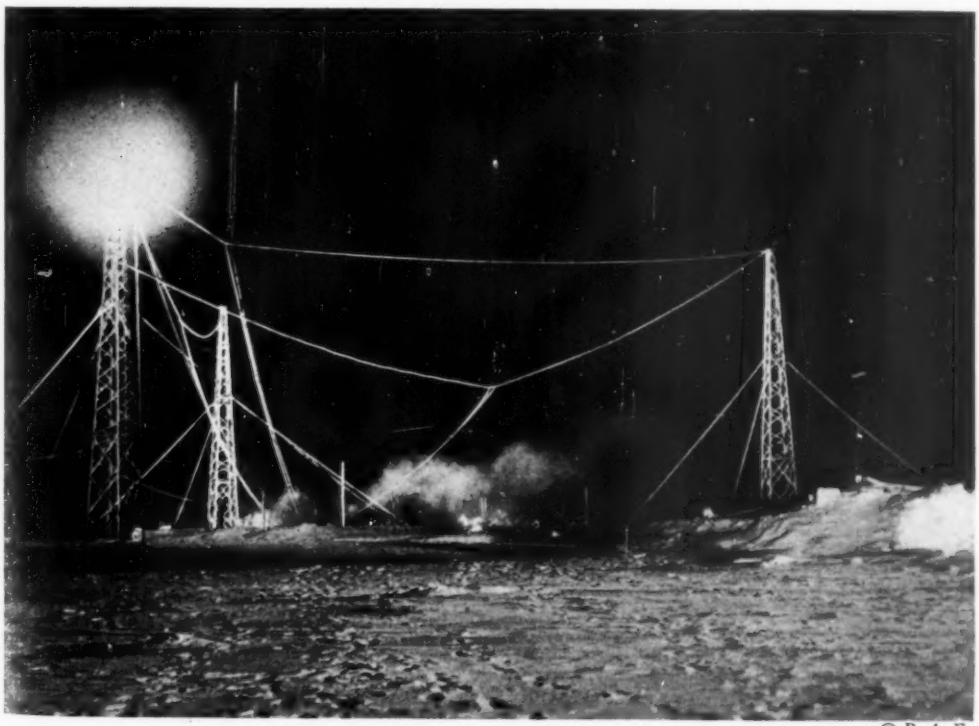
In two hundred years of Antarctic exploration, the questions that have been raised about this great expanse of land buried beneath the earth's largest remnant of the Ice Age are as many as the blocks of ice in the vast, floating pack that encircles it. To seek solution of a few of these problems and to do the seeking with all the practicable appurtenances of modern science was the chief aim of the expedition, though, as was inevitable, the first flight by airplane ever made over the South Pole was bound to receive the public's principal notice.

Obviously I cannot in brief space chronicle the many events of an expedition that required three years of preparation; that left New York in August, 1928, and did not return until June, 1930; that was moved about 20,000 miles in two ships, that built its own village upon the ice and lived in it, usually buried by snow, 2300 miles from the nearest human dwelling; that for nearly fourteen months thrived in an

almost lifeless land, in temperatures averaging about 16 degrees above zero in the warmest month and about 42 below in the coldest, did its work and returned without mishap. To tell a fraction of this story is impossible, but I may well touch upon some of the ways in which this big undertaking differed from expeditions of the past and pointed to the modern methods that will greatly hasten the future scientific surveying of Antarctica.

Perhaps first comes to mind the extensive use made of the airplane by this expedition, which landed three on the ice barrier and flew them with entire success both before and after the winter night and in temperatures that were always low and often severe. The significance of the airplane in exploration like that done from Little America as a base is two-fold: It covers distance in minutes and hours instead of days and months, and it broadens the horizon five-fold. Hardly less important is a third related consideration. Using an aërial camera, the explorer now for the first time is able to bring back indisputable evidence of what is seen over wide areas.

There is no better illustration of these points than the South Pole flight. Amundsen, in his heroic "dash" to the Pole by dog team and afoot, required nearly 98 days to go and come. The "Floyd Bennett" took us there and back, with a minimum of physical hardship, in 19 hours. While Amundsen at the best was observing a terrain visible on either side for a distance of 8 miles only, our horizon averaged more than 50 miles. On level snow he commanded a panoramic view of 75 square miles; at 10,000



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LITTLE AMERICA AT NIGHT

This view, taken in the light of flares, shows the base camp of the expedition, with towers and wires covered with hoar frost. At the left is the beacon light that guided parties home to camp

© B. A. E.

THE WATER SUPPLY

This photograph, taken in the winter night, shows part of the labor of obtaining water at Little America. The snow is being shovelled into a melting tank connected with the kitchen range

feet of altitude, we looked down on a visible world of more than 50,000 square miles, and at much lesser altitudes still immensely exceeded his range of vision. Further, as this expanse of milky snow and ice and looming mountains unfolded, Capt. Ashley C. McKinley, third in command of the expedition and its aërial surveyor, was taking—instead of mental or pencil notes—an overlapping photographic record. The area covered in that one flight of less than a day's duration was about 150,000 square miles, the new and less known portions of which almost literally were brought back to New York on photographic negatives. In the various flights 150,000 square miles were surveyed by camera, an area which, if you are curious to visualize it, almost equals that of West Virginia, Ohio, Indiana, and Illinois combined.

The expedition made in all 23 flights and traveled by airplane about 7085 miles. Through use of this modern aid, the airplane, it covered an area of 500,000 square miles, of which 250,000 had no overlaps and 200,000 square miles, it is estimated, never before had been seen by man.

At the South Pole we were some 800 miles south of Little America, which, as I have said, was 2300 miles from any dwelling. An airline between our plane and New York would have measured nearly 10,000 miles. Below was nothing but a level plateau of dazzling snow—which as the camera records it, looks like a sheet of pebbled white paper. So we might, in all truth, have considered ourselves to be stark alone at the "end of the earth." Yet, in point of fact, my message that we were in the vicinity of the South Pole was almost instantly received at Little America, and quickly relayed to *The New York Times*. News that under former methods of polar explora-

tion might have reached "the outside" in a year or more, thus became the property of the civilized world within a few hours. With the radio, "the outside" has been moved right into camp and into the kit of every airplane and sledge party. No exploring or survey party left Little America on an extensive trip without the means of communicating with the base by radio. Indeed, on one flight an operator, listening in at the *Times* station in New York, caught the exchange of messages between plane and camp. At another time, business messages were relayed from New York to Little America and thence to me in the air, and a reply relayed back to New York.

Shortly after we celebrated Christmas, 1928, by reaching the barrier ice in the Bay of Whales from our outside base at Dunedin, New Zealand, we had selected a permanent camp site on this great ice shelf a few miles inland, and hauled by dog sledge the 650 tons of supplies and material brought by the "City of New York" and the "Eleanor Bolling." The planes were one of our first concerns; as was the radio. Soon we had erected the three metal 60-foot towers and set up the mechanism of the Adolph S. Ochs station. Communication established, not a day elapsed whose events were not reported to the public. For the first time, a remote expedition was regularly breakfast-table news; for the first time, the members of such an expedition listened to radio broadcasts from a big city station and received word from their families; for the first time, business could be transacted between such an expedition and its headquarters 9000 miles away in an air line.

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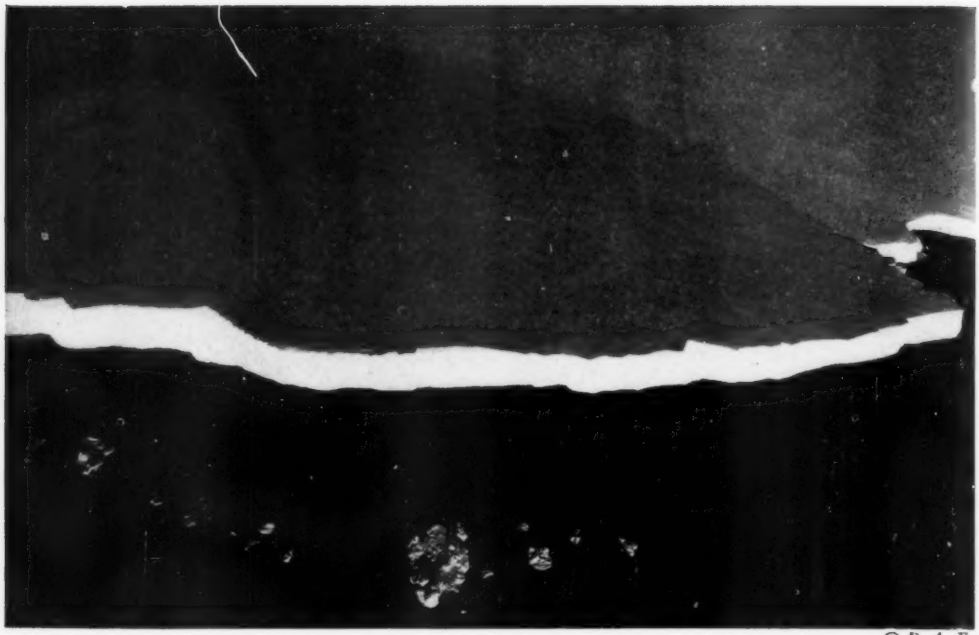
WINTERING THE POLAR PLANE

In its snow hangar the "Floyd Bennett," airplane in which Admiral Byrd flew to the South Pole, rested snugly from March until November



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THE BARRIER FROM THE AIR

Despite its appearance in the photograph, the ice edge at this point rises from 50 to 90 feet out of the sea, into which great chunks fall to float away

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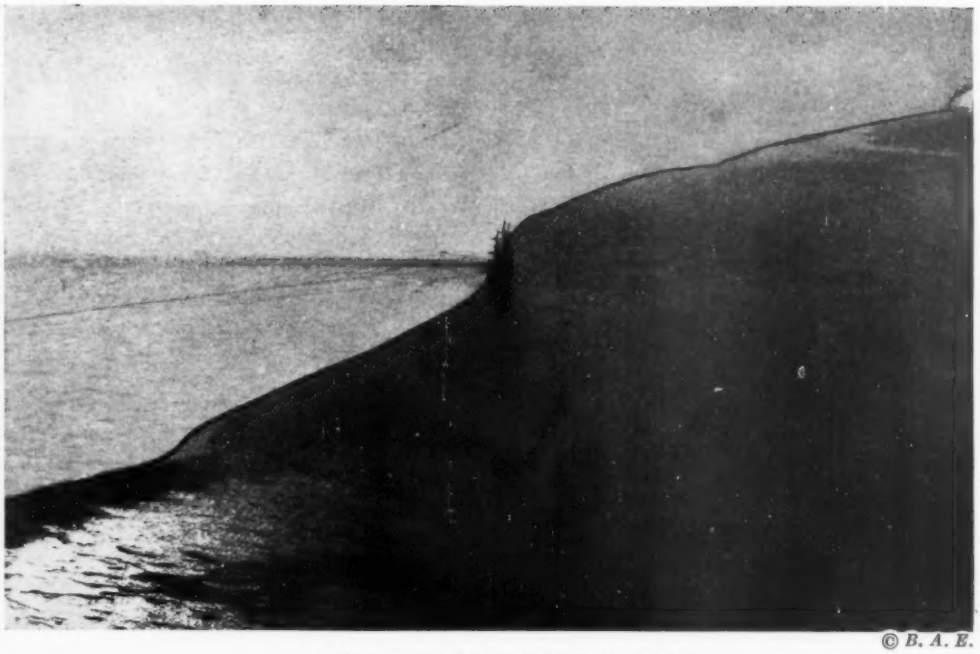
ON THE EASTERN FLIGHT

A study in light, shadow, and focus of an unusual formation of ice tongues in King Edward's Land; pressure ridges and crevasses in the foreground



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THE "CITY OF NEW YORK" AT DOCK

An air photograph of the scene in the Bay of Whales soon after arrival, with the "City" docked at the ice edge, here 5 feet high, and convenient for unloading the 650 tons of supplies sledged to the base

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ON THE POLAR FLIGHT

Ice masses and peaks—view from the "Floyd Bennett" when the plane was over Live Glacier seeking to avoid the higher peaks guarding the south polar plateau

© B. A. E.

STARTING THE "SUBWAY"
Digging one of the snow tunnels for communication between the buildings of Little America

From a snow-buried building of Little America—from the midst of a network of snow "subways"—to a steel building reared high above the roaring subways of Big America's biggest city were sent more than 300,000 words of press reports, detailing each scientific accomplishment and recounting the daily lives of the 42 men on the barrier. This achievement—due to the enterprise and scientific interest of a great newspaper, which could not hope for a return commensurate with the expense of arranging and maintaining this unique communication—seems all the greater when the business side of the expedition is considered. Through the air also 15,000 messages were exchanged between myself and Capt. H. H. Railey, my personal representative in New York, whose necessary activities in behalf of the expedition back home resulted at times in as many as 40 messages a day and an average wordage of 25,000 a month. The total words exchanged between the now silent Station WFA, Little America and New York—press, business and personal—exceeded 1,000,000.

The radio, however, was not limited in its functions on this expedition to the practical uses that proved so immediately valuable. Many phases of radio reception and sending under the unusual conditions that were inherent in the location were studied and recorded—for instance, the varying phases of the local heaviside layer throughout the seasons.

But radio and airplane were only two of an array of modern aids to scientific investigation contained in the expedition's equipment, which was unusually complete. All the instruments requisite for geological, weather, and other studies were at hand and put to thorough use. The data records are being worked up and studied—a labor which will require months more.

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ALWAYS IN TOUCH
The operator's ski serves as pole for this radio set used on sledge trips away from base

Reporting officially by radio in June, 1929, to the Secretary of the Navy on our discovery of the Rockefeller Range of mountains, I said, "Aviation has discovered a new land, surveyed it and landed on it for scientific investigation." Prof. Laurence M. Gould, second in command of the expedition, its geologist and a leader in various scientific endeavors, went by plane to the base of this range, made extensive ground surveys with which to check the air survey, and with his party climbed the mountains to study the rock formations and take specimens from several of the 40 peaks and ridges, the highest 2075 feet. Next season, Doctor Gould, using sledge teams— and let me say that the sledge dog, despite advances in science, is still indispensable in the Antarctic—laid a line of food and supply bases to the foot of the Queen Maude Range, and made a thorough geological study of the mountains and other formations at that point. Doctor Gould on this trip found sandstone and carbonaceous material, though his earlier findings had been mainly confined to granite.

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PLUMBING THE DEPTHS

Taking soundings off the ice barrier in the Bay of Whales, 1400 feet deep, close to Little America

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GETTING THE ANGLES

Admiral Byrd and Prof. Frank T. Davies, expedition physicist, surveying on the barrier

For nine months the expedition made continuous photographic records of the magnetic elements, supplemented by absolute measurements with instruments. This work, done under severe conditions in snow and canvas houses where the temperature averaged 20 degrees below zero, showed greatly disturbed magnetic conditions. The observations covered the maximum of a sun spot cycle of considerable importance. A very complete part of the magnetic study was the record—as to types, intensity, direction, and color movement—kept of the auroras, which occurred on 90 per cent. of clear nights.

As the Antarctic is one of the greatest birthplaces of "weather," we had the equipment of a first order Government

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READY TO COLLECT

Gould geological camp at the base of Queen Maude Range, from which the party ascended the glacier to the exposed strata above to take rock samples and to study formations

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SIXTY BELOW ZERO!

Prof. Laurence M. Gould, geologist and second in command of the expedition, finds his theodolite covered with hoar frost when he emerges to get a star sight

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CROSSING A CREVASSE

A dog team of the geological survey party halts at one of the numerous fissures that make travel hazardous on ice of the Bay of Whales

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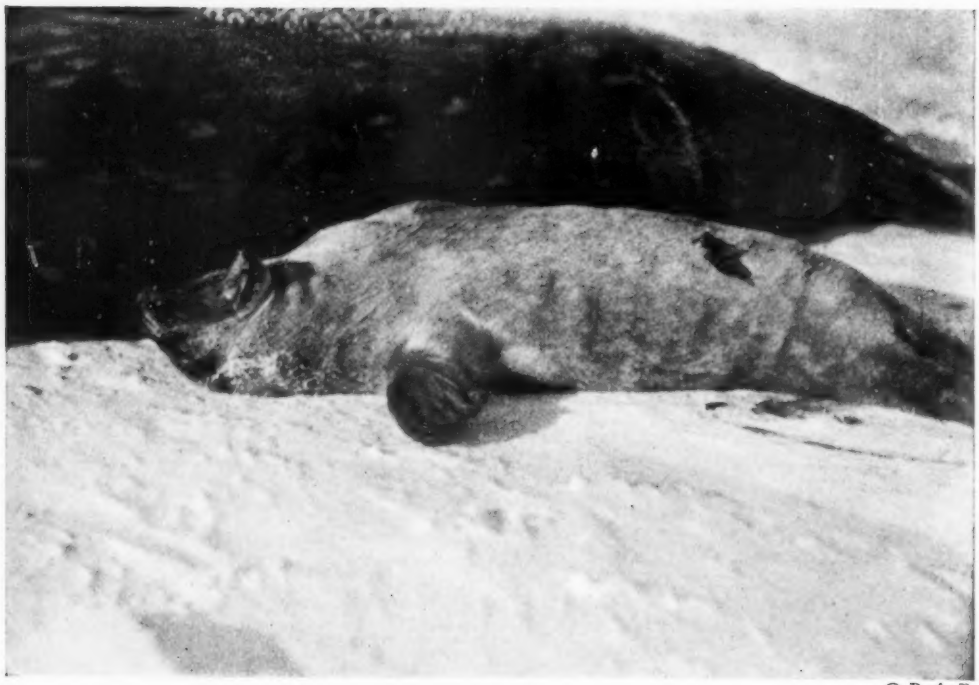
MUSIC FROM HOME

Members of the expedition under the snows of Little America listen to a radio broadcast from Big America. The activity in the foreground is the old Navy game of "Acy-Ducy"



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YAWNING IN EASE

A baby Weddell seal on the ice at Bay of Whales. One of the few forms of animal life at Little America, these seals, very tame, made an interesting study

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PERSONALLY POSED

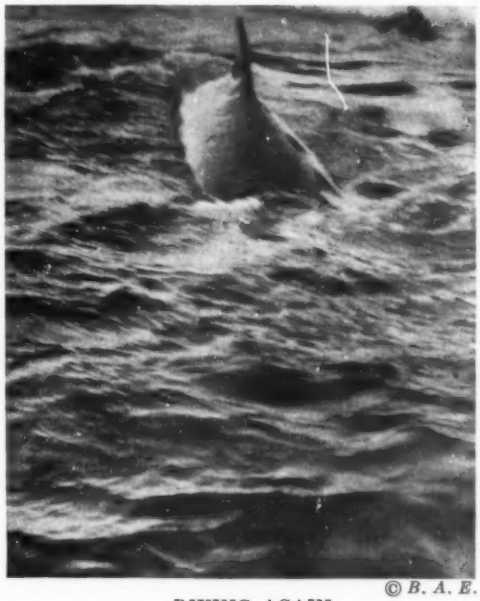
This whale, caught in an ice crack half a mile from Little America, and hesitating to dive under the ice, came repeatedly to the surface, a few feet from the camera

weather observation station in charge of William C. Haines, meteorologist, but carried our studies also into channels not usually entered. Hourly, day and night, we took a systematic record of barometric pressure, temperature, cloudiness and precipitation, wind direction and velocity, humidity, visibility, and other phenomena. With kites and pilot balloons we made investigations of the upper air, reaching in these soundings altitudes of more than 30,000 feet. To obtain wind velocities and directions at various altitudes we made about 400 pilot balloon observations. These were of immediate use in determining the advisability of making flights, but their significance is far greater, for they in all probability will throw most valuable light upon atmospheric circulation in high southern latitudes. An interesting 40-day continuous record, taken during the last of our stay, provides in detail

temperature, pressure and humidity at various levels.

Living upon a great ice shelf, we of course were curious as to how far below us was the solid land. Soundings with a sonic depth finder in the Bay of Whales close to Little America gave a depth of about 1600 feet, others to the south and east between 900 and 1000 feet. Other hydrographic work included study of sea life, and depositing message bottles, the recovery of which may some day add to our knowledge of Antarctic currents.

In addition to the meteorological temperature records, the expedition came away with data on the temperature of the ice barrier itself in relation to its physical makeup. Readings below the surface, checked against air temperatures and heat of sun, showed many interesting changes with the varying of the seasons. These records were made in snow



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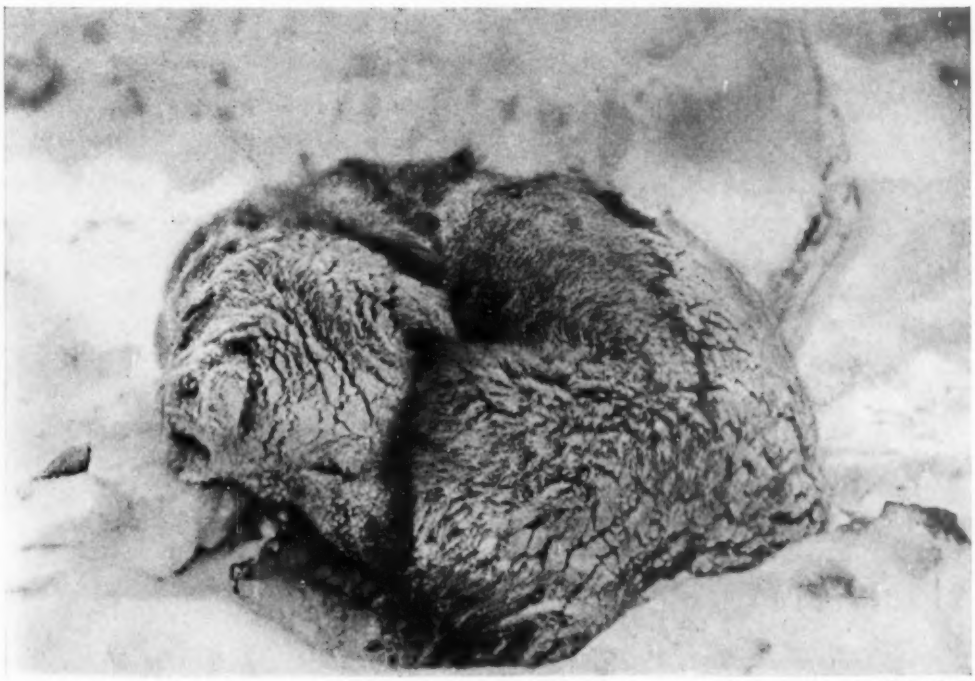
DIVING AGAIN

A finback whale sounds after coming to the surface in an ice fissure which he has decided is too small for comfort. These whales sometimes attain a length of eighty feet



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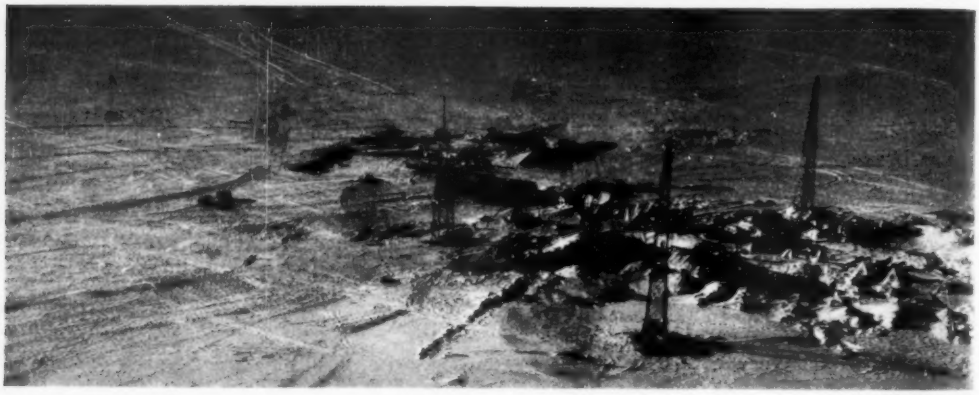
AFTER THE BLIZZARD

One of the expedition's sledge dogs asleep in the open, oblivious to a temperature of forty degrees below zero

tunnels, snow huts, crevasses, and at other subsurface locations where sun and air penetration might be expected to have an effect, or the extent of conductivity of the snow might be checked. Conditions at Little America gave splendid opportunity to measure the dust content of the air, which was determined to be about one half that found over the Pacific Ocean.

With the uniformly low air temperatures—almost never above the freezing point—it is rather surprising to examine figures obtained by our black bulb thermometer, insulated to register the amount of heat radiated by the sun, and find that it went as high as 115 degrees Fahrenheit above zero. A rule of thumb indication of the power that can be exerted by the sun in this bleak land was given by a black tarpaulin fifteen feet square, which sank nine inches into the snow in two sunny days.

At this writing nine men of the expedition besides myself are engaged in a study and arrangement of the scientific material that will require about a year to complete. These men are: Doctor Gould, geology and glaciology; Captain McKinley, aërial survey; Haines, meterology; Lieut. Malcolm P. Hanson, chief radio operator, radio engineering; Henry J. Harrison, Jr., aërology; Prof. Frank T. Davies, physics; Quin A. Blackburn, topography; George A. Thorne, surveys; and Dr. Francis D. Coman, biology. A compilation of this data is being put in book form, and may run to several volumes.



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HOME FOR FORTY-TWO MEN

The Byrd Antarctic Expedition's camp "Little America," for nearly fourteen months was the home in constant snow and cold of forty-two men. The air view (below) shows the camp nearing completion, the radio towers up, and snow excavated for placement of the photographic laboratory. The (top) picture, showing the completed camp in detail, is of a model of "Little America," executed by Mr. Leslie Morgan under the supervision of the American Museum's department of preparation

EXPEDITION CAMELS BEING WATERED IN THE SARI-SU

SAIGA ANTELOPE AND LONG-HAIRED TIGER

The American Museum Sends an Expedition to Asia to Collect Animals for Two Groups To Be Installed in the New North Asiatic Hall

BY WILLIAM J. MORDEN
Field Associate, Mammal Department, American Museum

The Morden-Graves North Asiatic Expedition of which Mr. Morden was leader, and George C. Graves, 2d, and George G. Goodwin the other members, arrived in the Soviet Union the twelfth of September, 1929. On a preliminary trip to Russia in 1928, Mr. Morden had made arrangements with governmental authorities and the Russian Academy of Sciences for visas, permits to operate, and letters of introduction, so that on arrival at Leningrad, the expedition baggage, consisting of about a ton of equipment and supplies, was quickly passed through the Custom House, and they themselves through the passport control at the pier. In Leningrad, as everywhere the expedition went in the Soviet Union, its members were treated courteously, and full assistance given them. From Leningrad the party went to Moscow where final arrangements were made for the first part of the expedition's work, the journey into the prohibited territory of Middle Asia, to collect an exhibition group of Saiga tatarica. ("Middle Asia" is the term used by the Russians when referring to Russian Territory. "Central Asia" is applied by them only to Chinese Turkestan.) Their object accomplished, the party moved on to the region of the Amur and Ussuri rivers for specimens of the Siberian long-haired tiger.—THE EDITORS.

THE saiga is a peculiar-looking chap. Perhaps the most striking part of his appearance is his big, floppy nose, which is prolonged into a sort of downwardly bent proboscis, with the nostrils opening downward. In addition to his weird-looking face, the saiga has a characteristic sneaking gait, and whether at a walk, trot, or run always holds his head low. Even when startled, he never raises his head, but peers at the object of his attention as though looking over the tops of spectacles. But though his gait is shambling, and his movements are far from graceful, the saiga will easily outrun a horse, and can cover several miles at good speed. He is a member of the antelope family, is rather slenderly built, and stands about thirty inches high at the shoulder. His summer coat is dull yellowish, becoming grayish in the fall and almost white in winter. *Saiga tartarica* once ranged over much of the steppe country of Central and Middle Asia and southern Europe as far west as the present borders of Poland. Today, however, they are found only in limited areas in Kazakstan, part of which used to be Russian

CAMELS OF A NATIVE CARAVAN

Natives of Kazakstan are nomadic. During the summer they live in yurts, felt tents commonly used in Central Asia. At the approach of winter all their belongings, including the yurts, are packed on camels, and the family moves on to a place where its herds can graze. The camel leading the procession shown in this picture, has on his back the heavy felt of a yurt. Women and children ride surrounded by these stiff folds, which protect them from the wind

Turkestan, and the Soviet government has strict regulations prohibiting their killing. The decimation of the once numerous herds is due largely to the fact that the amber-colored horns of the bucks, when ground into powder, constitute a much-prized ingredient in Chinese medicine. A pair of these horns will sell for from $100 to $150 (gold) in the bazaars, so saiga hunting has long been a lucrative business in parts of Middle and Central Asia.

There are few saiga in the museums of the world, and nowhere is there a habitat group of them, showing the animals in a setting that is, as nearly as careful observations and notes can make it, an exact reproduction of the country where the animal lives.

On my 1928 trip to Russia I was unable to learn exactly where I might expect to locate saiga, nor was I able now to obtain accurate information in Moscow. Some whom I questioned said saiga ranged in the region about the Aral Sea; others, near the Persian border in Turkmenistan; still others, in the Semiretchensk region of the western Altai near the borders of Chinese Turkestan. We were told that we might get more accurate information at the State University in Tashkent, so, having been granted special visas for Middle Asia, we went there, a four-day train ride from Moscow.

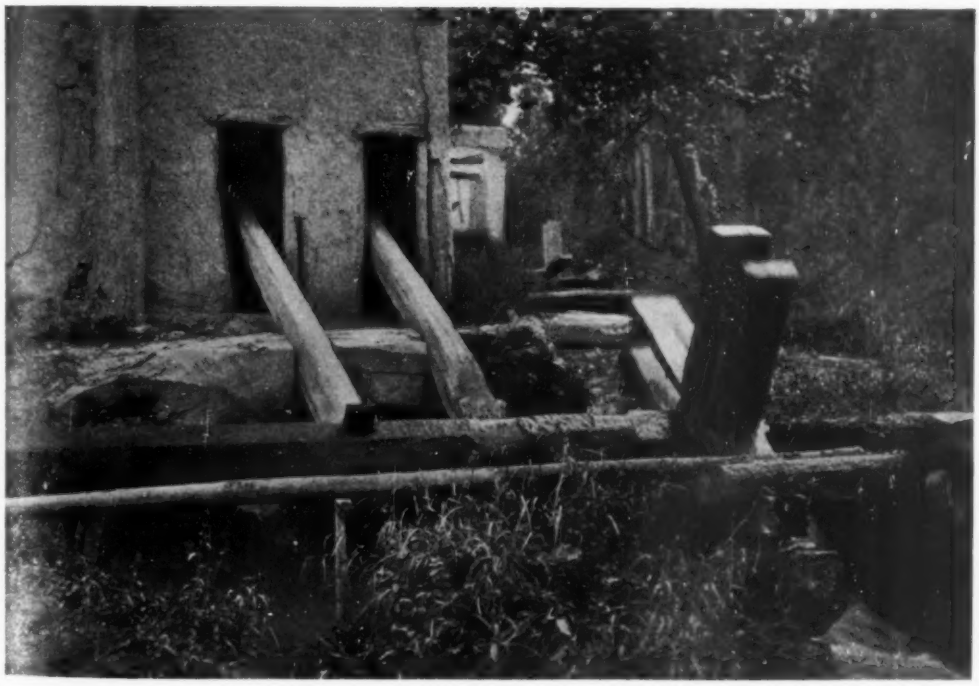
In Tashkent we were told that saiga had been seen the previous year on the desert steppes of central Kazakstan, but that it would be necessary to travel several hundred miles by camel caravan in order to reach their range. Our starting point was to be Kizil Orda, a small town on the railway some 250 miles north of

Tashkent, but first it was necessary for us to go to Samarkand and Bokhara, to obtain permits to hunt the animals.

At each of our stops in Middle Asia government officials met us, and motor cars were placed at our disposal during our stays in Tashkent, Samarkand, and Bokhara.

At Samarkand, the ancient capital of Tamerlane, and present capital of the Soviet Republic of Uzbekistan, we were fortunate to find one of the monthly bazaars in progress, to which natives of the surrounding country come for trading. In the bazaar, which is held in the old part of the city, were sections for trade in meats, sheep, donkeys, horses, hay, green alfalfa, rice, flour, peppers, miscellaneous vegetables such as potatoes, beans, peas, and tomatoes; in the fruit "department" I noticed blue Concord and green grapes, melons, pomegranates, raisins, prunes, and apples. There were sections for rugs and felts, brass and copper-ware, leather and hides, shoes and boots, clothing and caps, harness and saddlery, tinware, ironware, parts for the big-wheeled native carts known as *arbais*, horseshoes, locks and padlocks, and hinges for doors. Horseshoers, wheelwrights, and many other craftsmen each had their separate sections. Barbers shaved and clipped their victims alongside a wall. Hawkers of various small articles passed through the crowds, while camels, carts, Uzbeks on horses and Uzbeks on donkeys jostled with Uzbeks on foot, until it was almost impossible to move. The sun shone through a haze of dust on the gaily colored crowd, and trading went merrily on.

In the horse market, a runway of about a hundred yards in length gave opportunity to judge of an animal's gait, though so far as I could see, the horses



A WATER MILL IN SAMARKAND

This device for hulling rice grains is used in Russian Middle Asia, saving the heavy manual labor of pounding rice with a stone. Water from the stream turns the wooden wheel, causing weights fastened to the two heavy beams to fall into pits which are filled with grains of rice

ROASTING A GOAT'S HEAD

En route it was sometimes necessary to augment the food supply with domestic meat. This goat's head was skinned and roasted by a guide and presented to Mr. Morden as a choice morsel

moved only at the usual running walk of the Central Asian and Chinese pony. We were told that after the dickering which always precedes a sale, the buyer takes the seller by the hand if he decides to make the purchase, if not, he pulls his ear. We somehow doubted the latter, although we did see several buyers shaking hands and seeming well satisfied.

Here and there in the bazaar, as elsewhere in the city, were *chai-khanas* or tea houses, where crowds sat about on mat-covered raised platforms, and drank tea from china bowls. Several of the *chai-khanas* also sold *cheslik*, pieces of mutton skewered on thin, pointed rods, and roasted over a charcoal fire.

The Uzbeks, the inhabitants of Uzbekistan, are more Semitic than Mongoloid in facial characteristics. Their summer dress is of cotton, and many of the *khalats*, or loose outer cloaks worn by the men, are striped with gay colors. Small, round, skull caps are the usual headgear, although many of the older men wear turbans of either white or blue cloth.

The noise and confusion of the bazaar, where cries of vendors mingled with shouts of cart drivers and riders, the occasional gurgling scream of a camel, the milling crowd of gaily dressed Uzbeks, and the inevitable dust hanging over the scene, made a composite picture of Asiatic activity which in all probability has been little changed through hundreds of years.

During our month's travel in the desert on the trail of the saiga, we lived entirely in Kazak yurts, the domed, felt-covered tents used extensively by the nomad peoples of Central and Middle Asia. The present Kazaks, or more properly, Kirghiz-Kazaks, who inhabit the desert steppes of Kazakstan where our work took us, are of Turkish Mongoloid extraction,

A LOCAL HUNTER

He is holding the head of the prize saiga obtained by the expedition. As saiga horns are used for Chinese medicine and are worth $150 a pair, this animal is becoming very scarce

A NATIVE GUIDE

This guide had the reputation of being very skilful with a gun, but when he borrowed one of the expedition's rifles, he had to use a hinged, forked rest at the muzzle to steady it

and except where they have settled in comparatively small towns near the railways, are almost entirely nomadic. Many of them own rather large herds of camels and horses, and we saw some tremendous flocks of sheep and goats during our trek through the desert north of Kizil Orda.

It was necessary for us to employ guides who knew the water holes and where encampments of Kazaks could be located, as without local knowledge it would be quite impossible for a traveler to find his way in that trackless area.

The saiga are entirely desert dwellers, and though we were told that there would be little difficulty in locating bands of them in the country to which we went, actually when we arrived there we found that we were on the very edge of their range, and it was with the greatest difficulty that we finally located a band of the animals. When we questioned the local people we were told that saiga could be found everywhere; but it finally developed that the word *saigak* in Russian is a general term for any antelope or gazelle, and that while *jairon*, or goitered gazelle, were fairly plentiful in that area, saiga were almost unknown.

We were told many stories regarding the saiga and the prowess of local hunters. Some of these tales were rather amusing in the light of actual facts. Once we heard that saiga travelled in herds of a hundred or more; again, that they were never seen in bands of more than two or three; we heard that the natives killed them by driving the animals past a point where other hunters, armed with rifles, lay in concealment and killed them at short range; next day we were told that saiga were never shot at ranges less than several hundred yards. We learned that long and difficult stalks were necessary and were told that a usual method was to

TUNGUS HUNTING CAMP
The tents of these natives on a tributary of Ussuri, Eastern Siberia, are roughly similar to the tipis of the North American Indian

fire beyond the animals, so that they would become confused and stampede toward the concealed hunters. The best story of all, however, concerned the local hunter who was finally engaged as guide.

The story was to the effect that this chap was accustomed to chase saiga on horseback, and that his skill with a rifle was so great that on at least two occasions he had, while riding at a dead run, fired from his saddle and creased the animals, stunning without killing them. When the man arrived at our camp, I lent him my spare rifle. but until he had fitted a hinged rest to the muzzle, he could hit nothing but the broad desert, even when lying prone. Stories of this sort, while amusing, did not greatly assist us in gathering information. Accurate data regarding the animals and their habits were hard to obtain.

In hunting the saiga one rides across the tremendous plains which at a distance seem entirely flat but which actually are very gently rolling. At each slight elevation the hunter dismounts, and through field glasses scans the country. The work is more difficult because the sun's heat causes a mirage, which makes all objects at a distance seem to waver and float in the air. If any animals are seen, a long and careful stalk is necessary before the hunter can come within range, for the saiga, like most plains animals, keeps as far as possible out on flat areas where no cover for an enemy exists.

We considered ourselves very fortunate in obtaining one buck, two females, and three young animals for the Museum group. With these specimens, we brought back a sufficient amount of the low sagelike growth and other dried desert plants to make the foreground of the habitat group which will be installed in the North Asiatic Hall of the American Museum.

Due to bad water, I had a severe attack of dysentery, and this, combined with a rather seriously infected hand, and the necessity for constant hunting and long marches, wore me down pretty badly. Upon our return to Moscow in November, I was told that if I went to Siberia with the expedition at that time, I would, in all probability, stay in Siberia permanently. Doctors in Moscow advised me to go to Paris for examination and treatment, and this I did, sending Mr. Goodwin east via the Trans-Siberian Railway to meet Mr. Graves, who was due in Vladivostok in December. I was able to rejoin the expedition in January, however, and to continue with it until the finish of the work.

When I rejoined them, Graves and Goodwin were working in the Amur river district where we planned to collect an exhibition group of the tiger, (popularly known as the "long-haired tiger") which is found there and in parts of Manchuria.

Tigers are usually associated with India and other regions of Southern Asia, as it is in these lands that they are most frequently met and hunted. But there are reasons for the belief that the tiger is comparatively a newcomer to South Asia and that the genus originally inhabited much cooler areas. All tigers, wherever found, belong to the same genus, though they are subject to considerable variations in size, coloration, and length of coat.

It is a nine-day ride on the Trans-Siberian Railway from Moscow to Khabarovsk, the point from which we traveled by sleighs about 150 miles down the Amur River to the country where tiger were reported. Although it was midwinter when I reached Khabarovsk, the weather, while cold, was not as bitter as we had expected. Minimum temperatures ran to 40° below zero Fahrenheit, but there was little wind in the forests and the air was very dry, so these temperatures were not particularly uncomfortable. Working with unprotected hands for more than a moment or two was out of the question, but we used the tents with which the expedi-

MR. MORDEN USING AN EYEMO MOTION PICTURE CAMERA

Recording scenes in a native village on the Amur River. Mr. Morden is wearing native-made fishskin shoes that are stuffed with grass for warmth

TRANSPORTATION IN THE SNOW

Dog sledges were used for carrying equipment and supplies when the expedition entered the forest of the Amur River section. From four to seven dogs were the usual number for each sledge. The driver is also in harness and can help the dogs to pull over difficult places

tion was provided, and at night our reindeer-skin sleeping bags kept us comfortable. We had brought with us reindeer-skin double parkas and fur trousers, but these were found too heavy when we were traveling on foot. They were useful, however, when we were riding in sleighs.

Our transportation, when moving from place to place along the Amur River or its larger tributaries, was horse-drawn sleighs, but when we went farther into the interior and took the frozen surface of the smaller streams, dog sledges were necessary. At these times we ourselves traveled on foot.

We found the snow from two to three-and-a-half feet deep, and when it was necessary to travel anywhere but on the ice of the rivers, we needed skis. We had brought along Norwegian skis and Yukon snow-shoes, for before arriving in the country it was impossible to learn what conditions we might find. Upon arrival, however, we discovered that the Norwegian skis were almost useless, due to the fact that in the forests the underbrush was so dense that these otherwise very useful articles could not be handled. We might have used our Yukon snow-shoes, but found that the native skis were faster and more easily handled in the thick timber. The native skis are made of ash or other hard woods and are about six inches wide by about six feet long. The bottoms are covered with moose hide with the hair pointing toward the rear, so that the wearer is able to travel uphill with ease, an item of importance when much of the travel is over rough country.

When using the skis, we wore native-made shoes of fishskin, so designed that the toes are pointed and turned sharply upward. This shape allows the toe of the shoe to be hooked under the cross piece of the lashing, and helps to hold the ski on the foot. Inside the shoes we wore

two pairs of heavy wool stockings, and in addition, the shoes were packed with a dry grass which grows in that country. This grass, called by the natives *naukhta*, is a very efficient insulator, and except when wet, keeps the feet quite warm even in the coldest weather. Watching a native pack his fishskin shoes with *naukhta*, one has the feeling that he will never be able to get the mass of loose grass into the shoes and still have room left for his feet. He very cleverly works it in, however, and packs it down, and I did not see a single one make a miscalculation in the amount of grass needed. The fishskin from which this rather crude-looking footgear is made, is taken from the salmon which abound in the Amur River. The natives of the region are largely fish eaters, and fishing is the principal activity of the Goldi tribe which lives along that section of the Amur and for some distance up its tributaries.

The Goldis are a branch of the Tungus and are related to the Manchus, the people of Manchuria, whom they resemble in facial characteristics. Their religion is Shamanism, and the Shaman or "medicine man," as we would term him, plays an important part in the life of the villages. Their small houses are usually constructed of logs, plastered over with clay. A visit to the interior of one of these houses is interesting, particularly after the visitor has become accustomed to the violent odor of fish, which at first is almost over-powering. The houses usually have two rooms, one of which is used as a kitchen and the other for sleeping and general living purposes. Two small open fireplaces, one on each side of the door leading from the kitchen into the sleeping compartment, serve the double purpose of cooking, and of warming the sleeping room, as flues from them pass under sleeping platforms in the larger

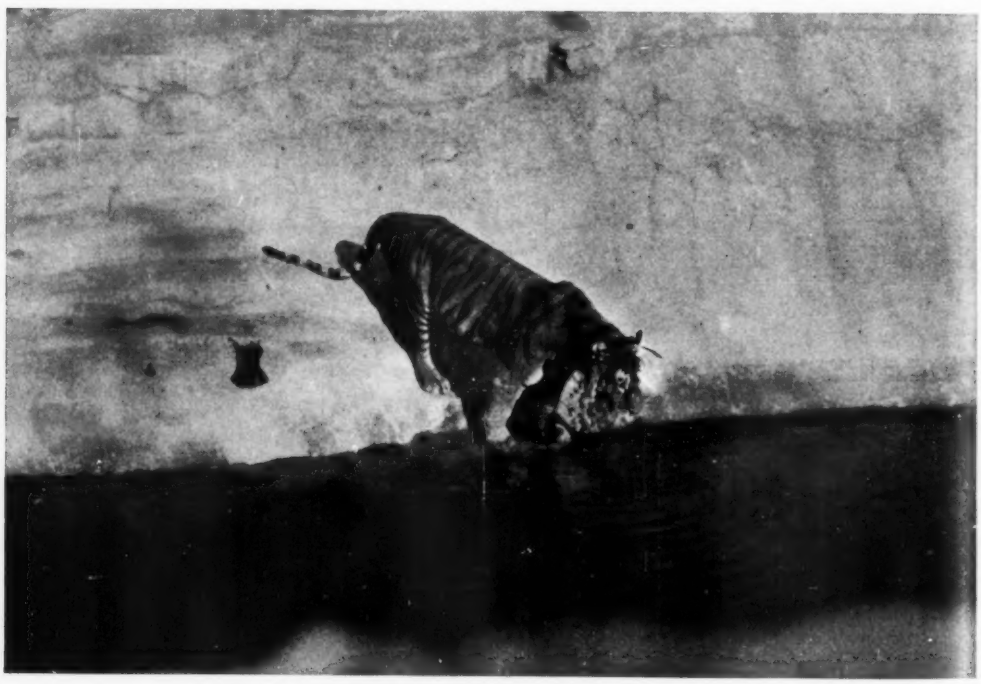
CAMP IN THE "TAIGA"

The expedition spent three months in the "taiga" or "the Siberian forest," where the temperature sometimes dropped to thirty and forty degrees below zero

room. The platforms, which are covered with straw matting, are raised about two feet from the mud floor of the building, and the smoke and heat from the fires, passing through the flues, keep them quite warm even in the depth of winter. On these platforms the whole family and any guests sleep side by side. Guests are not, presumably, supposed to look too closely at what is under the matting. We did on one occasion, and found it rather densely populated, with the result that our night's rest was not as peaceful as it might otherwise have been. After passing under the sleeping platforms, the smoke from the fireplaces is led underground to a tall stack, which rises some ten feet beyond the end of the house. These detached chimneys are characteristic of all Goldi villages.

To the Goldis, as to other tribes of the region, the tiger is a deity, and we sometimes had difficulty in finding natives who would agree to lead us to the country where tigers were known to be. For a consideration we were able to obtain guides and dog drivers, but all of them went without any great enthusiasm. In one instance the Shaman of the village danced for hours to propitiate the tiger deity, so that no misfortune might befall the village because one of its members had engaged himself to a party which might possibly encompass the destruction of one of these holy animals.

The Russians in that section are, almost to a man, afraid of tigers. We hired one Russian who had a local reputation as a hunter, but he finally refused to go into the forest until we had hired another Russian hunter as a companion. Both of these men, we learned later, were squirrel hunters by profession, and from the beginning it was quite apparent that neither of them had, as we would say, "lost any tigers." We decided that both



A SIBERIAN TIGER

This tiger, photographed in the Moscow Zoo, was in its summer coat. In the winter the hair on some parts of the body of this species is three inches long

were much more afraid of meeting a tiger than of not finding one.

When we first arrived in the country, we heard the usual tales. Many of them were to the effect that the Siberian tigers were often man-eaters, and most were unanimous that a tiger, when followed, would invariably circle and lie in wait near its trail to ambush the tracker. These last stories cheered us greatly, for if they were true, it seemed to us that we might have a first-class chance of meeting and killing a tiger which was waiting to bite us. As a matter of fact, we found that while tigers sometimes do circle, and may for a time watch their own back trails, ordinarily the tiger, when he finds himself followed, will clear out. One non-Russian whom we met, a trapper who had been in that country for several years, told us that he had trailed tigers on numerous occasions, but had never been able to come up with one. He said that at one time he was evidently not more than an hour behind a tiger which had passed near one of his trap lines, but though he followed this animal on skis all day, he was unable to catch up with it. So far as he could see, he said, the tiger had never tried to ambush him.

DEEP FOREST NEAR EXPEDITION CAMP

The trees at this point along one of the tributaries of the Amur River are larch. Deeper in the "taiga" pine and spruce, which grow to considerably larger diameters than larch, are more abundant

Although doubtless the Siberian tiger is responsible for a few deaths, as nearly as we could learn, many of the stories of man-eating tigers are fabrications. Some of these tales apparently have been told to cover up murders. In one or two stories that came to us, murders had been committed and the deaths of the victims had been laid to attacks by tigers. It seemed probable to us that while the Siberian tiger, if starving, or if wounded or cornered, would be very savage, under ordinary circumstances when game was plentiful, he would be no more likely to turn man-eater than would be his relative, the tiger of South Asia.

We found a great many tiger trails, and the freshest ones of these we followed, but the forest was so thick and the snow was so deep that we could never cover more than a few miles a day. Further-

A "DEADFALL" TRAP
Used by the local Russian trappers for small mammals. Yellow mink is the most frequent catch, and the pelts are taken to near-by villages for sale

more, it was quite impossible to travel silently, and a tiger could very easily hear us and could, of course, move much faster than we. With a pack of trained dogs, it might be possible to come up with one of the animals, for well-trained dogs would follow a fresh trail much faster than we could, and upon coming up to a tiger, would keep it occupied until the party arrived. This method, we heard, had been used, but there were no dogs available in the sections in which we worked.

The three specimens (two large males and one female) that we finally obtained for the North Asiatic Hall in the Museum, were killed with trap guns, or more properly, gun traps. These are smooth-bore, single-barreled shot guns, set up on stakes a few feet from a trail where animals are known to pass occasionally. The gun is lashed on the stakes and is so aimed that the bullet will cross the trail about eighteen inches above the snow level. A piece of wood, pivoted to the stock of the gun, has a bit of string extending from its upper end to the trigger. From the lower end another piece of string or fine wire is stretched across the trail about a foot above the snow and fastened to a tree. The action of this gun trap is simple. When a large animal, following the trail, strikes the string, the pull is transmitted through the pivoted piece of wood to the trigger and the gun is discharged. The alignment is carefully worked out so that the slug will strike the animal at the shoulder or just behind it. These trap guns are set up mainly for wild pig, roe-deer, stag, and other forest animals, although a few tigers are killed by them.

When a tiger is killed, the hunter is fortunate, for a tiger will bring the lucky trapper as much as $400 and this amount he can take out in supplies at the Soviet trading store, if he wishes. Inasmuch as food supplies and manufactured articles are very scarce, and comparatively little can be bought on a ration card, a credit of several hundred dollars which can be applied directly to the purchase of food and manufactured articles is of even more value than the same amount would otherwise be.

We had heard reports of the tremendous size of the tigers of the Amur River region. The two big males which we obtained were nine feet seven inches, and ten feet in length, respectively, measured from nose to tip of tail, and these lengths are no longer than those of big Bengali specimens. Our Siberian tigers, however, were heavier and more powerfully built than any Indian tiger that I have seen. One of our big fellows weighed 480 pounds and the other 550 pounds. Both of them were slightly less than three feet high at the shoulder. The heavy coat of hair that this animal grows in winter, which gives the Siberian its popular name of "long-haired tiger," makes him considerably more bulky in appearance than the smooth-coated tiger of more southern countries.

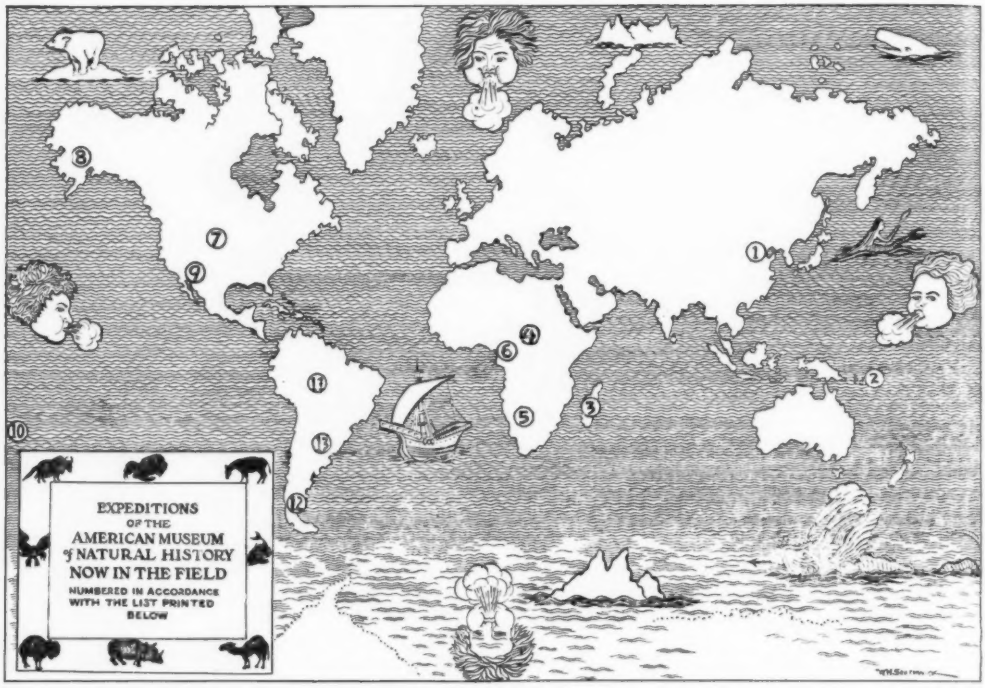
I have seen it stated that the tigers of the Amur River are lighter in color than those found in South Asia. Our experience and information show, however, that these northern tigers are subject to rather wide variation in the ground color of their coats. One of our big specimens was a rich dark yellow, while the other, which came from exactly the same region, was quite light. Inquiries at the trading company's office indicated that there are as many of one as of the other. The Siberian, however, often has considerably more white on face, sides, and underbody, than has its relative from South Asia.

Ordinarily the favorite food of the tiger is wild pig, of which there are many in the forests where it ranges. These pigs, in turn, feed upon the small cones of the stone-pine, which form a considerable part of the forest. We were told that some winters, when there is a poor crop of pine cones, the pigs will leave a particular section, and that that year almost no tiger tracks are seen there. Tigers also kill a number of other animals. We found one freshly-killed carcass of a stag, which a tiger had pulled down and partly eaten, and one of the specimens which our expedition obtained had a piece of horse meat and hide in its stomach. We were told that once in a while a tiger becomes a cattle killer and makes such a great nuisance of itself that the whole neighborhood has to combine forces to kill it.

At the end of April we left the Soviet Union with our original program accomplished. We had obtained two groups, the saiga and the Siberian tiger, together with about three hundred specimens of small animals and birds. Some of the latter were quite rare and many of them were new to the collections of the Museum.

GUIDE AND DOG DRIVER WITH SKIS

The skis, which are six feet long and six inches wide, are made of ash. The bottoms are covered with moose hide, with the hair extending toward the rear, thus enabling the wearer to travel uphill



1. Central Asiatic Expeditions; 2. Whitney, South Sea, Solomon Islands, for birds; 3. Madagascar, for birds, mammals, and fossils, 4. Chapin, Congo, for birds; 5. Vernay, Africa, for mammals; 6. Columbia University-American Museum, to Africa for anatomical study; 7. Frick-Falkenbach, Nebraska, for fossils; 8. Kaisen, Alaska, for fossils; 9. Frick-Rak, New Mexico, for fossils; 10. Shapiro, race mixture studies in Hawaii; 11. Olalla Brothers, Brazil, for birds and mammals; 12. Scarritt, Patagonia, for fossil mammals; 13. Naumburg-Kaempfer, Southeastern Brazil, for birds

AMERICAN MUSEUM EXPEDITIONS AND NOTES

EDITED BY A. KATHERINE BERGER

It is the purpose of this department to keep readers of NATURAL HISTORY *informed as to the latest news of the Museum expeditions in the field at the time the magazine goes to press. In many instances, however, the sources of information are so distant that it is not possible to include up-to-date data*

CENTRAL ASIATIC EXPEDITIONS.—Since the latter part of May, the Central Asiatic Expedition has been engaged in field work in the Gobi Desert and will probably continue there until the first of October. Already Roy Chapman Andrews, the leader, has reported a successful season. The remains of the shovel-jawed mastodon and a few other animals of the Pliocene age have already been secured.

In the meantime the manuscript for the volume on the Permian of Mongolia by A. W. Grabau has been compiled and sent to the printer. It is expected that this will appear sometime early in the winter.

THE THORNE-CORREIA EXPEDITION.—During July Mr. and Mrs. J. G. Correia returned to the United States from the Spanish Island of Fernando Po in the Gulf of Guinea. They were unable at the present time to complete their field work as planned through the generosity of the late S. Brinckerhoff Thorne because Mr. Correia was confined to the hospital at Santa Ysabel from December until March with an attack of African sleeping sickness. During his illness he received the best medical treatment in an institution notably well equipped for combating tropical diseases. He has come through without any serious aftermath, although a number of patients stricken at the same time did not recover.

Fortunately, the expedition had succeeded in carrying out most of the plans at the four principal islands in the Gulf of Guinea. The collection of birds from this region is the first comprehensive one in America. These, together with photographs and notes will serve as a basis for an ornithological report upon the region. It is

hoped, moreover, that at some future date, Mr. and Mrs. Correia will have an opportunity to complete their comprehensive survey in the higher zone of Fernando Po, and at the same levels of the mountains in Cameroon on the adjacent African mainland.

THE SCARRITT PATAGONIA EXPEDITION.—Dr. G. G. Simpson left New York in August for Patagonia, to collect fossil mammals in the oldest South American geologic strata of the Age of Mammals. Mr. Coleman S. Williams, scientific assistant, and Doctor Simpson will meet other members of the expedition in South America. The party will be absent about a year, and while planning to spend most of that time in the field, also expect to study the collections in the Argentine Museum.

THE MYRON I. GRANGER ARCHÆOLOGICAL EXPEDITION.—After an interruption of twenty-seven years, the American Museum was this year able to resume its field work in South American archæology and ethnology. The project undertaken this time was an archæological reconnaissance in Peru and Ecuador, made possible through the generous assistance of Mr. Myron I. Granger.

Dr. Ronald L. Olson, assistant curator of South American archæology, has returned from seven months of preliminary exploration and excavation. The major portion of the work was done in the highlands and in Ecuador. Excavations were made in the coastal valleys of Nazca, Ica, Chincha, Cañete, Ancon, Huarmey, Viru, and Chancay, and in the valley of the Utcubamba (an eastern affluent of the Rio Marañon). The specimens obtained will be of great service in the study of older collections in the Museum, many of which are without adequate data. Of particular interest are the items from the Ica-Nazca and Trujillo regions. The interrelations of the several epochs of the old civilizations of Peru are as yet almost unknown, but hints were secured which should prove valuable leads in such future work as the Museum hopes to undertake.

ARCHÆOLOGICAL WORK IN THE SOUTHWEST.—Clark Wissler, curator-in-chief of the department of anthropology made a field trip to southwestern United States during the summer. A few days were spent in Arkansas in the vicinity of Hot Springs, where, under the guidance of J. R. Fordyce, a number of archæological sites were examined. Also a visit was made to the State University at Fayetteville to study the collections in the University Museum. The next stop was at Carlsbad, New Mexico, where the country around the famous caves of that name was covered. A number of interesting sites on the Park property were visited and in company with Mr. Carl Livingston a number of Basket Maker caves in an adjoining canyon were examined. The remainder of the season was spent in the neighborhood of Santa Fé, New Mexico. Ceremonies were observed in several Indian villages and opportunity taken to study the collections in Santa Fé. While a guest of the Director of the Laboratory, Mr. Jesse L. Nusbaum, Doctor Wissler, as a member of the Board of Directors of the newly established Laboratory of Anthropology, reviewed the program for construction of buildings and improvement of the grounds.

Finally, Mr. Richard M. Snodgrasse, a member of the field staff of the Department, was visited in eastern Colorado. Mr. Snodgrasse is following up traces of the peculiar culture first coming to notice in association with skeletons of extinct bison found at Folsom, New Mexico, several years ago. He reports that excavations are now in progress at two promising sites.

THE AMERICAN MUSEUM-MADAGASCAR EXPEDITION.—Richard Archbold has just returned from the Mission Zoologique Franco-Anglo-Americaine in Madagascar. Up to the time of his leaving, there had been collected in all about 8000 birds and 1000 mammals. Among these there is one specimen of the rare hawk (*Eutriorchis astur*) and a series of *Monias benschi* a rail-like bird whose position is not as yet clearly known. Four specimens were obtained of the large catlike *Fossa*, as well as a fair series of the large tailless lemuroide *Indris*. Rand and Du Mont, Mr. Archbold's assistants, remained to finish working the north and northwest of the island. The mission has actually been in the field a year and three months, and has worked the whole of the island south of Tananarive with the exception of Fort Dauphin.

THE COLUMBIA UNIVERSITY-AMERICAN MUSEUM ANATOMICAL EXPEDITION.—Mr. H. C. Raven is still in the interior of the French Cameroon in charge of the joint expedition from Columbia University and the American Museum of Natural History.

AS a member of the Bermuda Oceanographic Expedition of the New York Zoological Society, in charge of Dr. William Beebe, Dr. William K. Gregory spent a month at Nonsuch Island, Bermuda. In collaboration with Doctor Beebe he secured many valuable notes and

drawings illustrating the architecture of the skull of deep sea fishes, for their joint report on this subject.

THE SALAMANDERS OF WEST VIRGINIA.—During the summer, Dr. G. Kingsley Noble made a short expedition to the mountains of West Virginia to study the ecology of salamanders. His investigations included the altitudinal study of life on Spruce Knob, the highest mountain in West Virginia, and he brought back with him a large collection of living salamanders for further study under controlled conditions.

MAMMALS OF CONNECTICUT.—During August Mr. George G. Goodwin of the American Museum spent three weeks collecting mammals at Macedonia Park, Connecticut. This concludes the field work started two years ago by Mr. Goodwin in connection with a study of the mammals of that state, for a Bulletin he is preparing for the Connecticut Geological Natural History Survey. The collections made this summer, together with those obtained in 1928, now number 430 specimens.

The special object of this last trip was to secure the rare *Synaptomys* or bog lemming, two of which were obtained in a bog on a mountain-side. These are the first recorded for the State.

The American Museum collection now contains, with the exception of a few extirpated fur-bearing animals, all the species known to exist in Connecticut.

CHAPIN CONGO EXPEDITION.—In a letter dated July 17, Dr. James P. Chapin writes from Léopoldville on the Congo to Dr. Frank M. Chapman, that, thanks to the cöoperation of government officials, his work in connection with collections of material for the faunal habitat groups representing bird life of tropical African forests is progressing most satisfactorily.

It will be recalled that Doctor Chapin previously spent six years in the Congo on American Museum field work, leaving there in 1915. In his present letter he says in part:

> The changes in this part of the Congo since 1915 are very striking. Matadi is about three times as large as it was—they were aided by a fire that burned down part of the business quarter. Kinshasa is a mushroom town, but very well built for the most part. In 1909 it was merely a group of baobab trees—I see them still from the hotel verandah—with four or five brick buildings belonging to the State, and one trading company.

NOTES

LUCRETIA PERRY OSBORN

ON August 26 last, Lucretia Perry Osborn, the wife of Henry Fairfield Osborn, President of the American Museum, died at Garrison, N. Y.

The many friends and colleagues of President Osborn sorrow with him at this great loss, and extend to him their heartfelt sympathy.

At a meeting of the administrative and scientific staffs of the American Museum of Natural History, held on August 26, 1930, the following minute was adopted:

> The staff of the American Museum of Natural History learns with deep sorrow of the passing away of Lucretia Perry Osborn, wife of our beloved president, Henry Fairfield Osborn.
>
> Throughout President Osborn's long and distinguished career as a palæontologist and as a leader in this Museum and allied institutions, Mrs. Osborn has been his greatest inspiration, his most loyal and ardent supporter. In their charming homes at Garrison, N. Y., and in New York City she was an ideal hostess to President Osborn's innumerable official and informal guests and thus did much to establish friendly contacts for the Museum. She accompanied Professor Osborn to the various scientific meetings both at home and abroad and played a prominent and most gracious part in the social amenities of these occasions. She was intensely interested in Professor Osborn's scientific discoveries and her own book on evolution entitled *The Chain of Life* is a lucid summary of his views on this subject.
>
> Mrs. Osborn's friends will cherish delightful memories of her brilliance and keenness, of the nobility of her character and of her courage in defense of her ideals.
>
> We therefore beg to convey to President Osborn and to his family this expression of our deep sympathy.

AMERICAN MUSEUM HALLS

THE SOUTH ASIATIC HALL.—During the past few years there have appeared in NATURAL HISTORY from time to time articles and notes concerning the new South Asiatic Hall, the material for which was collected by the late Col. J. C. Faunthorpe and Arthur S. Vernay and presented to the American Museum by Mr. Vernay. At last the Hall is nearing completion, and it will be formally opened on November 17. This occasion will be a gala one, and various dignitaries of England and India have been invited to be present.

In the November-December issue of NATURAL HISTORY will appear photographs of the many striking and impressive groups of this new hall.

NEW AMERICAN MUSEUM BUILDINGS.—Excellent progress is being made on the new American Museum buildings which have been provided for by appropriations from the City and State, and through a gift of Harry Payne Whitney. The Power and Service Building which will house the heating and lighting departments and also the department of preparation, is so far advanced that it is expected it will be ready for occupancy the first of January.

The Akeley-African Hall will be completed, it is hoped, by the first of April. Plans and specifications for the Whitney Hall of Birds have been compiled and are being submitted to City authorities for final approval and for the letting of contracts.

The State Roosevelt Memorial Hall, being erected by the State of New York, which immediately adjoins the South Asiatic Wing, the African Hall, and the Whitney Wing, is now under construction. It is expected that this will be completed in 1932.

CONSERVATION

RETURN OF THE SEAL.—It is extremely encouraging to conservationists who are downcast and hopeless at times to record certain triumphs of conservation of animal life, such as the revival of the American bison and the increasingly bright prospects for saving the American antelope. Neither of these animals is of commercial value. We are hopeful that the great international movement for the commercially valuable whale will be crowned with success similar to that which has rewarded the efforts to save the seals.

In a recent radio talk, July 16, 1930, Doctor Charles H. Townsend of the New York Aquarium gave some outstanding figures, as follows:

It was my fortune to see the great fur seal rookeries of the Pribilofs many years ago, before the destructive ocean sealing industry began. The seals were then roughly estimated at a few "millions." In the late Nineties, when the herd had been greatly reduced in numbers, I participated in the actual counting of seals occupying the breeding grounds. With the herd on the increase the annual "census" of breeders that has been made since then, will become more difficult and will eventually become impracticable. As I saw them in 1885 they were considered "countless" in the sense that buffalo on the western plains, and antelope in Africa were countless.

At one time there were more than sixty vessels engaged in killing fur seals at sea. As the seals killed were largely females, the business was destined to break down for lack of seals to keep it going. When ocean sealing was suppressed by international treaty, fur seals began to increase. It is greatly to be regretted that islands in the southern hemisphere inhabited by fur seals have not been protected like those of the Bering Sea. Had it not been for indiscriminate and wasteful killing, the supply of skins of fur seals need not have failed as it did. It is altogether likely that under the present methods of conservation, the supply of skins of fur seals may be increased to even greater numbers than were available forty-five years ago.

As a result of *long continued* seal killing *at sea* by British, Japanese, and United States vessels, the *Pribilof herd* of seals had been brought to a very *low ebb* by the year *1910*. Sealing by *vessels at sea* had almost *ceased* to be *profitable* and the killing of *surplus male* seals on the islands by the *United States Government* had been *greatly reduced*. A *treaty* providing for the *cessation of ocean sealing* for a term of *fifteen years*, was entered into by the United States, Great Britain, and Japan, including also *Russia* to whom the *Asiatic fur seal* herd inhabiting the *Commander Islands*, belonged. Under the *protection* thus afforded the *tide* of *seal life* rose steadily. The United States *Bureau of Fisheries* announces that about forty-five thousand skins will be taken this year.

The *benefit* to the *breeding herd* resulted from the great saving of *female* seals which had always constituted *the bulk* of the catch made *at sea*. As the stock of seals increased on the *islands*, it became possible to take more skins of *superfluous males* of these highly *polygamous* animals.

The once common *sealskin cloak* is *reappearing* and will afford some *respite* to the *small fur bearing* animals already *threatened with extinction* all over the world, by reason of the insistent *demands* of the *fur trade*. The outlook for the restoration of the Asiatic herd to its *former commercial importance*, is *unfortunately*, not *promising*. During the world war the Commander Islands received little *protection* from Russia, with the *result* that the seal rookeries of *those islands* were often *raided* by *sealing vessels*, with disastrous results to the stock of *breeding animals*.

If complete protection can be secured, there are small groups of breeding seals remaining on the rookeries of the Commander Islands that might be sufficient for the eventual *restoration* of the sealing *industry* on those islands.

The fur seal herd of the small Robben Island in the Okhotsk sea, belonging to Japan, is reported (census of 1926) as consisting of 24,373 animals. The number of surplus males taken in that year by the Japanese government was 1,332.

THE CHILDREN'S FAIR

THE American Institute Children's Fair is to be held at the American Museum this year from December 4 to December 10. Entry classes are planned to cover all fields of science of interest to young people, and all school children eighteen years of age or younger are eligible to become exhibitors. The fair is arranged by the School Nature League of which Mrs. W. C. Popper is president. Entry blanks and full information may be obtained from Mrs. Marjorie G. Coit, School Nature League, Room 206, American Museum of Natural History, 77th Street and Central Park West, New York City.

FOSSIL MAN

MANY recent excavations, in Greenland, Moravia, Palestine, Africa, China, Italy and Germany, and several important discoveries, make occasion for a fascinating review of the subject of fossil man by Sir Arthur Keith in *Nature* for June 21, 1930.

First, though probably not most important, is the finding of a fossil human skull, at Gardarene, Greenland. This skull, with a jaw more massive than has ever before been found in a human specimen, has led to a reopening of the discussion of the characters of the ancestral type. Prof. F. C. C. Hansen, of the University of Copenhagen, who describes this skull (*Homo gardarensis*) believes it to be an atavism rather than a unique survival of the type, while Keith offers an alternative explanation, supported by the evidence of similar skulls preserved in the Royal College of Surgeons, that it represents merely an acromegalic condition of the individual.

Keith makes note of the enormous strength of the lower jaw, the platelike buttresses of bone at the base of the skull, the sharp bending of the occipital part of the skull (as in *Pithecanthropus*, Peking man, and the Rhodesian skull), the expansion of the temporal muscles of mastication upward until they almost meet on the top of the head (as in the female gorilla), the evidence that the forehead was low and receding, the unique length of the skull (nearly an inch longer than

the longest fossil human skull known), the length of the face (two inches longer than that of the average Norseman). The conditions are all characteristic of acromegaly and Keith finds appearances in the bone structure that suggest the abnormal nature of the growth.

Excavations in Moravia reveal a type with only local differences from the Cromagnon of France, the Predmost type being shorter, stouter and of more muscular build than the tall Cromagnons. Keith finds the racial kinship of these early whites neither in Africa, Australia, nor Asia. "They are Europeans or proto-Europeans," the differences being expressed chiefly in size of jaw and robust development of face and of thigh bone. He believes their descendants may still survive in Europe, though much modified by the stresses through which their ancestors passed during the third phase of the Ice Age, when stature was shortened and jaws took on the strength shown by those of modern Eskimo. Yet skulls of that period are still Caucasian in nose, forehead, chin, and face. Later, under modern climatic conditions, these early massive characters were lost. The race as a whole was small-boned, of small stature, and large heads and strong jaws were exceptions. The question raised is whether the modern races were the degenerate descendants of the Cromagnons or new invaders of Europe. Keith thinks the latter more likely.

Excavations in Palestine show the same succession between the old Neanderthal and the neanthropic (modern) types of culture as in Europe. Remains found in caves on the west shore of Lake Galilee, at Shukbah, and on the western slope of Mt. Carmel, reveal the ancient Mousterian stone culture either directly overlain by the Aurignacian or found in near-by caves. In the Galilee cave a skull of Neanderthal type was found; at Shukbah among later Aurignacian strata all the remains were of neanthropic type. In the Carmelite cave a small-sized type was found, neither Neanderthal nor Cromagnon, neither Jew nor Arab. These people had the low-bridged, flat negroid nose but they were European both in shape of skull and proportions of limbs. Keith suggests their derivation from North Africa or affinity with inhabitants of Algiers or Tunis in Capsian times. These researches in Palestine are of great value as they carry human history into a far more remote past than do the records of neighboring countries.

Fossil man in Africa presents mixed traits that make a baffling problem. Keith mentions three types represented by skulls in the Royal College of Surgeons. The first, the skeleton of a man, is from Kenya Colony and shows points of resemblance to the Cromagnon type; the stone implements used by this race are also similar to those of the earliest Cromagnons. This seems to favor the idea that the latter may have migrated to Europe from Africa, but Keith thinks the migration may have been *into* Africa from some other point, possibly from Arabia or southwest Asia, as all the country between Kartoum and Kenya is now occupied by Negro tribes and the ancient Kenyans were not Negroes. Keith suggests that they may have been an early Hamitic race and he follows the trail of modern Hamitic man toward the straits of Bab-el-Mandeb and Arabia, which in Cromagnon times were fertile. It is here that Keith looks for the source of the common cultural and racial traits of early Europeans and Africans.

The second African skull represents an early stage of the Bushman skull, while the third is of the Australoid type and is probably an offshoot of the same stock as the fossil skeleton discovered in the northern Transvaal and described by Doctor Broom (*Nature*, March 16, 1929).

All these discoveries reveal great development of body and brain in Palæolithic man but that the modern loss in size and strength is not wholly chargeable to modern civilization is proved by a comparison of the early Bushman skull with that of modern Bushmen. His descendants retain his hunting mode of life and yet have undergone the same reduction in size of jaws and face that is seen in a comparison of the modern European with the Cromagnon type.

The discovery of remains of man at Chou Kou Tien, thirty-seven miles southwest of Peking, is noted by Keith as of special interest because nothing has been known before of the prehistoric type in Asia and because it shows the evolutionary stage reached by Asiatic man at the beginning of the Pleistocene period. Three previous discoveries in other parts of the world had shown us three other types of man belonging to this period,—*Pithecanthropus* in Java, *Eoanthropus* (Piltdown man) in England, and *Palæanthropus* (Heidelberg man) in Germany. Of these three, Keith finds the closest relationship of *Sinanthropus* (Peking man) with *Pithecanthropus* but there is also some resemblance to Heidelberg man. The latest evidence indicates that the formation in which *Sinanthropus* was found is early Pleistocene and the stage of evolution is shown by the complete absence of hearths or any signs of fire and of all worked stones or shaped bones. One difficulty in dating the specimen is that the brain capacity of *Sinanthropus*, which is just within the minimum human standard and a little larger than that of *Pithecan-*

thropus, makes necessary either a very rapid evolution of the brain during the Pleistocene or else the assignment of a much longer time than has been given to that period; for even the maximum estimate allowed to it (one and one-half million years) seems very short to account for the difference between the brain of *Sinanthropus* at the beginning and that of La Chapelle man at the end. Keith suggests as a possible explanation that the races represented by *Pithecanthropus* and *Sinanthropus* may not have represented the highest stage in brain development in their own time. While *Sinanthropus* lived at the eastern end of the Old World, Piltdown man lived at the western end and is much nearer to the modern type.

Comparison of the two types shows that Peking man has the flattened head (seen before only in *Pithecanthropus*), the great bony beam across the forehead (found in Neanderthal man), a chin transitional between simian and human, teeth with a mixture of very ancient and very modern characters and many other traits which make him, according to Doctor Black, a possible ancestor of the Neanderthal races. Piltdown man, on the other hand, has no resemblances to *Pithecanthropus* nor to the Neanderthal and the conformation of skull bones and of head foreshadow features of modern man. Keith maintains that he was not of low type of organization of brain and even the lowest estimates of his brain capacity bring him well within the modern standard. Keith also adduces the artefacts found by Reid Moir in Pliocene deposits of East Anglia as evidence that Piltdown man was a skillful maker and user of tools, and thus makes claim for England as leading the world in Pleistocene times according to our present knowledge.

Coming to preglacial times, six Mousterian stations have been uncovered, with ancient types of stone implements, within ten miles of Rome. In 1929 a skull of Neanderthal man was found in deposits of the river Aniene with fossil bones of the elephant, rhinoceros, hippopotamus and horse, of species living in Italy before the last Ice Age. The skull as described by S. Sergi is altogether different from that of modern man and appears almost a duplicate of the Gibraltar skull found in 1848, also that of a woman. The brain capacity of each is less than 1200 c.c. The faces are long and gorilline, with large noses and strong bony tori above the eye-sockets. The discovery shows that in Italy as in France Mousterian culture was Neanderthal culture and that this race probably occupied all of Italy as well as other parts of Europe.

In Germany at Taubach and Ehringsdorf other preglacial remains have been found, notably part of a human skull described by Weidenreich in 1928. Keith notes the chief differences from later Neanderthals as a high vaulted skull and certain primitive features of the jaws. The fact that severe wounds had been inflicted on the forehead of the fresh skull is interpreted by Weidenreich as evidence of cannibalism in the ancient Ehringsdorf people.

Another still incomplete announcement has been made of a more recent discovery of fossil man at a site fifty miles northeast of Sebastopol, which has been confirmed by Boule as of Neanderthal type.

Neanderthal man's first appearance is an open question like that of his final disappearance, although in certain features he was foreshadowed in Heidelberg man. Keith finds strong evidence from the fossil skull of a boy found at Gibraltar that the race did not decline for lack of brains. He summarizes our present knowledge of the subject somewhat as follows:

Neanderthal man ranged from Weimar in the north to Malta in the south, from Jersey in the west to Palestine in the east. Over this range were several local races, some going back to the early part of the last interglacial period, others to the first part of the last glaciation. For a long part of the Pleistocene all inhabitants of Europe were members of this race. An unanswered question is whether they became transformed into modern man or died out completely. Keith disagrees with Hrdlicka, who holds the first view, and thinks it more likely that Neanderthal and modern man were "not father and son but cousins." He gives as reasons the fact that no skulls have ever been found which show mixtures of the two races or can be regarded as transitional and that no trace of Neanderthal man is found in any deposit later than those of Mousterian culture.

The question to which all discoveries so far made contribute an incomplete and tantalizing reply is: where did the first white (Caucasian) races come from when they made their first apparently sudden entrance into Europe at or near the beginning of the middle period of the last Ice Age,—an entrance followed by as sudden an extinction of the Neanderthals, up to that time in sole possession of Europe? Keith thinks the evidence favors the view that the first arrivals of these races came from Asia rather than from Africa.—W. K. Gregory

EARLY Discoveries of Tertiary Man.—It appears that proofs of the existence of man in Tertiary time were discovered no less

than thirty-nine years ago but not recognized as such. In Professor Osborn's presidential address before the American Association for the Advancement of Science,[1] December 27, 1929, he attributed prior credit to Mr. J. Reid Moir of Ipswich and Sir Ray Lankester in view of the discoveries set forth in their papers of 1909–1911. It seems, however, that the first flint implement from the Foxhall pit was found as far back as 1888.

Mr. Lewis Abbott (*Nature*, July 19, 1930, p. 104) dwells upon the importance of the East Anglia evidence in any discussion relating to the antiquity of man, and especially of Tertiary man, and enumerates some of the finds which might have gone to strengthen Professor Osborn's case. He refers to the first "indubitable" find—the stiletto made from the base of a deer's antler found in the Corraline Crag at Allborough, Suffolk, some fifty years ago. A well-made flint implement was found in the Foxhall Crag pit, Ipswich, in 1888. This is the pit which was afterwards the site of Mr. Reid Moir's discoveries. At Thorpe Neswick several worked flints were found while men were digging out the rib of an elephant, and were accepted by the late H. B. Woodward—a very cautious observer—as of human workmanship. Mr. Abbott also refers to the finds made by Mr. Savin and others in the Cromer Forest Bed. These flints were first brought to light at Runton in 1888 on the same occasion as the finds at the Foxhall pit, during the East Anglian Excursion of the International Congress of Geologists, when the party had been joined by the principal East Anglian geologists. Mr. Savin resumed work on the Cromer Forest Bed in 1895, and an exhibition of his finds was held at Burlington House, arousing much interest. These finds, Mr. Abbott points out, show that evidence for Tertiary man had been obtained from the Forest Bed thirty-one years, and from the Corraline Crag thirty-nine years, before the date claimed by Professor Osborn.

Sir Edwin Ray Lankester took, during nearly the whole of his life, a deep and abiding interest in prehistoric archæology. . . . When, between 1860 and 1890, the extensive diggings in search of "coprolite" were being made in Suffolk below the Red Crag, Lankester's attention was drawn to the remarkable series of mammalian, and other fossils, contained in the Bone Bed at the base of the Crag. The examination which he carried out of these remains resulted in the publication, in 1870, of a paper in the *Quarterly Journal of the Geological Society*, in which, for the first time, a detailed and lucid account was given of the varying age, and nature of the contents of the Suffolk Bone Bed. Lankester was, in fact, the greatest authority upon this deposit and its associated problems, and, to the last, his interest in it never waned. During the year 1909 Reid Moir discovered beneath the Upper Pliocene Red Crag at Ipswich a number of flints which, after due consideration, he decided had been flaked by man. If this conclusion were correct, it meant that the long-debated question as to whether human beings were present on this earth in Pliocene times was at last to be settled. It meant, also, that, in all probability, a long and heated controversy would be inaugurated when Moir's claim to have discovered the flint implements of Pliocene man was made public. Moir made known his claim by means of a letter to the *Times* which was published on October 17, 1910. Lankester was much impressed and in a paper before the Royal Society in November, 1911, laid great and—as has since appeared— justifiable stress upon the beak-like implements, to which he gave the descriptive name "rostro-carinate," and drew attention to the fact that this type had been hitherto unrecognised by archæologists. His examination of these particular specimens from below the Red Crag had enabled him to realise the ideal design which the flint flakers of Pliocene times had, as it were, set before themselves, and this ideal was closely approached in a wonderfully symmetrical rostro-carinate found in the Stone Bed beneath the Norwich Crag. This implement, discovered by the late W. G. Clarke, was named by Lankester "The Norwich Test Specimen," and described by him in an elaborate monograph published as an "Occasional Paper" by the Royal Anthropological Institute.[1]

[1] "Discovery of Tertiary Man." *Science*, n.s., Vol. LXXI, No. 1827, pp. 1–7, Jan. 3, 1930.

[1] Excerpts from J. Reid Moir: Obituary Notice of Sir E. Ray Lankester. *Proceedings of the Prehistoric Society of East Anglia*, Vol. VI, Part II, pp. 140–2.

MARINE LIFE

DURING July Dr. Roy Waldo Miner, accompanied by Arthur A. Jansson, was engaged in securing photographic and motion-picture studies of the inter-tidal zones on the shore of Nahant, Massachusetts, in connection with work planned for the Hall of Ocean Life.

OTHER MUSEUMS

A BIOLOGICAL STATION FOR THE SOUTHERN APPALACHIANS.—Mr. Clifford H. Pope has recently returned from a vacation spent at Highlands, N. C., where he participated in a conference of biologists held at the Highlands Museum. This conference was led by Clark Foreman and was attended by fifteen scientists representing thirteen important institutions. It was decided at the meeting to promote the establishment of a biological research station in the southern Appalachians and to this end the Museum has become incorporated as The Highlands Museum and Biological Laboratory.

Highlands was chosen as a site for the proposed station because of its natural advantages. Most important of these is the rich life of the region representative of the Transitional and even the Canadian zones. The flora and fauna have been well preserved because deforestation has not occurred, while the permanence of the forests is assured by the fact that Highlands itself is surrounded by National Forests. The Highlands region is a plateau with an average elevation of 4000 feet, while surrounding peaks reach an altitude of more than 5000 feet. These figures show that a station situated here would be in the very midst of the interesting biota characteristic of the southern Appalachians. The physiographic features of the plateau are extremely varied, cascades, streams, gorges, lakes, swamps, etc., being much in evidence. Finally, High-

lands itself is not only easily reached from the North as well as from the extreme South, but also from this point one can readily visit such places as the Smoky Mountain National Park, the Nantahala, Pisgah, and Balsam ranges. Also, by a very quick gradient, one descends to the Piedmont Plateau and from thence to the Coastal Plain.

On the advice of Dr. E. G. Conklin, who was also present at the conference, it was decided to adopt a program of a five-year experimental period in order thoroughly to test Highlands as the most suitable locality and to prove the desirability of a mountain biological station in the southern Appalachians. Funds are now in hand to build the first laboratory unit. The present Museum building was erected in 1928. The director, Dr. E. E. Reinke, professor of biology at Vanderbilt University, has, with the help of two assistants, carried on the work of the Museum through the last two seasons.

BOTANICAL SURVEY OF CANADA.—Dr. M. O. Malte, chief botanist, National Herbarium of the National Museum Branch of the Dominion Department of Mines, Ottawa, attended the International Botanical Congress, which was held at Cambridge, England, from August 16 to August 23. Before and after the Congress Doctor Malte visited the British Museum and the Kew Botanical Gardens in London, England, to study collections of Arctic flora in these museums. Doctor Malte also visited the Botanical Museum at Copenhagen, Denmark, for the same purpose.

For several years Doctor Malte has been engaged in an investigation of the flora of Arctic Canada, in coöperation with Dr. C. H. Ostenfeld, director of the Botanical Gardens, Copenhagen, Denmark. The report on the flora of Arctic Canada, which is in course of preparation, is the first of a series comprising the results of a botanical survey of the whole of Canada.

SCIENCE OF MAN

THE RECENT DEATH of Dr. G. L. Wilson was a source of great regret to his friends and associates at the American Museum. For many years Doctor Wilson, who was a special field worker in the department of anthropology, made collections among the Village Indians (Hidatsa-Mandan) of North Dakota which now constitute most of the American Museum's exhibit for those tribes. The model of an earth-lodge in the Plains Indian Hall was constructed from plans and data supplied by him. His field studies were chiefly among the Hidatsa and it is generally recognized that these were rigidly scientific, in fact, setting a high standard in such work. Among his publications are a series of books on the American Indians, written for young readers and for school use. In the Anthropological Series of the Museum there have appeared two important papers, one on the domestication of the dog and horse by the Hidatsa and the other on the capture and confinement of eagles for ceremonial purposes. These papers are the most exhaustive and authoritative of their kind and still stand as the chief source of reference for the Indians of the Plains. Doctor Wilson's best known work is a study of Hidatsa agriculture, a type study for the aboriginal tribes of the Missouri Valley. He leaves a number of unfinished papers, fortunately in such form that they can be published.

VOSS BEQUEST FOR ANTHROPOLOGICAL RESEARCH.—By the will of the late Frederick G. Voss there has come to the American Museum a special fund, the income of which is to be applied to research in anthropology. This generous bequest will enable the department of anthropology to take up several new investigations and to send out several field parties. Thus, this season's archæological work will be undertaken in Colorado, making excavations and surveys, relative to the so-called Folsom culture, a type of early prehistoric Plains Indian culture associated with an extinct species of bison. The results of this undertaking promise to be of importance in determining the prehistory of man in America. Another project supported by this fund is the collection of palæolithic and neolithic specimens from Central Europe under the direction of Curator N. C. Nelson. The data and collections resulting from this project will greatly improve Museum exhibits and facilities for the study of early man in Europe. Plans for other projects are now being formed looking toward a continued and fruitful program of anthropological research. The Voss Bequest is thus one of the turning points in the history of anthropology in this Museum.

A VISITOR'S IMPRESSION OF THE AMERICAN MUSEUM

IN the July, 1930, issue of *Natur und Museum* appears the following travel letter by Fritz Dreverman, giving his impression of the American Museum of Natural History, after his trip through the natural history museums of North America in the early part of 1930:

The Natural History Museum in New York is the proper climax to a short trip through the natural history museums of the United States. Here criticism is silenced, for so great is one's admiration that all to which one might perchance take exception is lost in the general impression. The fact that the size of the exhibits makes it almost impossible to note and lay stress upon all the details, may serve as an

excuse for the incompleteness and brevity of this report. The general impression is and will remian unforgettable.

The entrance hall with the meteorites, Darwin Hall, the Hall of Ocean Life, in course of preparation, numerous bird and mammal groups in which, despite the excellence of the older presentations, one recognizes everywhere progress and intelligent effort—all this fascinates the museum man. Luminescent deep sea fishes, a towering cliff at the ocean's edge with nesting and flying birds, areespecially remembered, and every Museum visitor will find pleasure in seeing the distant land and the dark, deep sea here brought before his eyes. One senses how the thoughts of the explorer, the teacher, the preparator, and the artist have become harmoniously blended, one feels the love for the poor children of the huge city who never get out where they can revel in the love of nature. An effort to produce the very best can be felt everywhere.

The palæontologist is particularly captivated by the fourth floor. The thrills which ran up and down my back in the Hall of Dinosaurs, the enthusiastic admiration for the results of the Central Asiatic excavations, and the pleasant sensation that nowhere a rigid pattern holds sway, but that, for example, one can take an animal, as in the case of the horse, and connect its past and present, a thing which is apparently also being planned in the case of the elephant and which has been so successfully done in the presentation of man—all this makes the visit a pleasure. It must be glorious, for example to be able, unrestrained by financial or other considerations, to place a galloping greyhound beside a galloping horse! Here I would insert a motion picture.

The intellectual life of the Museum goes far beyond the exhibitions. The School Service Division, the coöperation of the Staff in animal conservation, in the establishment of conservation parks, etc., are examples of the activities which show that here the exhibits are but a nucleus around which everything is arranged which joins mankind with nature and maintains the connection. I do not like to mention names, but that of Henry Fairfield Osborn must be mentioned. For in him the great investigator is combined with the solicitous financier and the kindly man with a genuine love for those who cannot see the whole, as nature gives it to them, but to whom the substituted Museum must drive home the magnitude of creation.

One thing, however, I will say for those who believe that the exhibits are the most important factor of a museum: nowhere does the excellent comparison of a museum with an iceberg come so true to the mark as in New York! In the latter, as in the former, only an eighth is visible, seven eighths however are invisible—there in the gray-green ocean—here in ten thousand drawers at which Research is working.

Whoever wishes to make a trip through the natural history museums of North America, let him not stop in New York but go right on. He will then, when he finally sees the Natural History Museum in New York, after all the others, have the feeling, as did I, of a mountain climber to whom the last peak scaled brings all the joy of beauty and perfection.

ERRATUM

IN an article on "Altamira" which appeared in the July-August issue of NATURAL HISTORY, the word "one" on the fifteenth line of the last paragraph, page 434, was incorrect. It should have read "no."

"TRUMPETING THE ADVANCE"

THE cover design of this issue, entitled "Trumpeting the Advance," is from a painting by Arthur A. Jansson of the American Museum's department of preparation. It shows an enlargement proposed for the elephant group which is to be the dominating centerpiece in the forthcoming African Hall. To Carl Akeley's existing group, "The Alarm," as a nucleus, would be added, if the proposal were carried through, the two elephants shown in the foreground and the two in the background—thus making a group appropriate to the proportions of the hall. The subject of the cover was chosen for this issue because its forward moving, vital power is symbolic of the Museum's present and potential contributions to the knowledge of Nature.

NEW MEMBERS

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum, making the total membership 12,121.

Fellow

MR. C. OLIVER O'DONNELL.

Life Member

Miss MARTHA TOOTHE.

Sustaining Members

Mrs. GERTRUDE E. CASE.

Misses JOSEPHINE COLGATE, AMELIA B. HOLLENBACK.

Messrs. C. O. G. MILLER, ANDREW WINEMAN.

Annual Members

Mesdames R. W. BOLLING, FRANCES H. HARRIS, CHARLES E. HEMING, FRANK H. KEEN, RICHARD F. MAYNARD, GILES WHITING.

Misses MARY A. BROWER, JESSICA SHERMAN.

Doctor FRANK FREELAND.

Messrs. FREDERIC ATTWOOD, ALEXANDER C. CAMPBELL, BURNHAM S. COLBURN, NATHAN HASKELL DOLE, ARTHUR H. FLEMING, SYDNEY E. FLETCHER, HENRY B. GOODFRIEND, ROBERT D. HOFFMAN, PHILIP KLAMAN, VICTOR LINCK, CHAS. C. ORCUTT, CARL H. PFORZHEIMER, JR., ACHESON SMITH, BENJAMIN STRONG, JR.

Associate Members

Mesdames RANDOLPH L. EDDY, M. B. EDWARDS, GEO. NOBLE JONES, HOWARD E. PERRY.

Misses BERYL B. BARD, MARY H. BOWSER, EMILY JOHNSON, EDNA P. LANE, CARMEN A. H. MCLAUGHLIN, EDITH M. MILLER, STELLA C. UTT, A. W. ZIMMERMAN.

Professor Dr. CATERINA ARUFFO,
Professors FRANKLIN C. ROBERTS, G. T. WICKWIRE.

Doctors HEMAN HUMPHREY, MORRIS F. KORN, C. S. ROBINSON, PAUL F. RUSSELL, W. V. STOUGH, JOHN E. SUTTON, F. N. H. VAN DOORNINCK.

Lieut. LOUIS T. HEATH.

Messrs. WM. B. ADAMS, JAMES W. ALLISON, HAROLD C. AMOS, GEORGE H. BAKER, THOS. G. BARD, ROBERT B. BEALE, DEAN BLANCHARD, RANDOLPH BOLLES, EDWIN BORCHARD, ALLAN J. CLARK, W. DONALD CONKLING, HARTLEY DENNETT, RALPH W. DOX, A. EISINGER, E. EPSTEIN, RAYMOND J. FOWLER, JAMES H. GAUL, HAROLD GIFFORD, JR., L. R. HAGEN, CLAUDE C. HAMEL, BRYAN A. HERMES, OSBORNE HOOPES, WALTER H. LEWIS, ARTHUR LITTLETON, C. F. MARTIN, W. S. MAXWELL, PERRY MCNEELY, GEORGE L. MIRICK, RANDOLPH C. MORRIS, S. K. PEARCE, WARD B. PERLEY, THURSTON M. PHETTEPLACE A. F. RODDY, W. C. SAYLOR, FRED. B. SCHAAF, B. S. SCHINDLE, C. A. H. SMITH, CLAUDE A. TEMPLETON, DAVID E. THOMPSON, WALLACE TODD, RICHARD A. WORRELL, R. P. WRIGHT.